Soils of the Municipality of Elton
Report No. D96

2020

Manitoba

SOILS OF THE MUNICIPALITY OF ELTON

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Additional Poster-Sized Maps Included with Report (Back Pocket):

1:20,000 Soil Series Maps for Each Township (six maps)

1:20,000 Agricultural Capability Maps for Each Township (six maps)

Part 1 General Description of the Study Area

1.1 Location and Extent

The Rural Municipality (RM) of Elton covers approximately 57,776 hectares (ha) (142,767 acres) of land in six townships (TWP). Townships 11 and 12, of Range (RNG) 17W, 18W and 19W. The RM of Elton is located in southwestern Manitoba and shares borders with the RMs of Oakview, Riverdale, Cornwallis, Minto-Odanah and North Cypress-Langford (Figure 1). The RM of Elton has three towns, including Forrest, Justice and Douglas.

The RM of Elton has an average annual temperature of 2.2 C and an average annual precipitation of 474 mm. The study area has a total of 1,630 growing degree days (GDD) above 5 C and an average of 119 frost-free days (Environment Canada 2019).

Soils in the RM of Elton have been previously mapped at the 1:126,720 scale in the Reconnaissance Soil Survey of the Rossburn and Virden Map Sheet Areas, Report No. 6 (Ehrlich et al., 1956), and the Reconnaissance Soil Survey of the Carberry Map Sheet Area, Report No. 7 (Ehrlich et al., 1957). More detailed information at 1:20,000 scale for part of the RM is reported in the Soils of the Brandon Region Study Area, Report No. 30 (Michalyna et al., 1976). Section 31-12-18W was mapped at a highly intense level of survey (1:5,000) in soil report 94-3 Soils of the Manitoba Zero Tillage Research Association Farm (Podolsky and Schindler 1994).

1.2 Physiography and Surface Deposits

The study area lies within two ecodistricts – the Hamiota (753) and the Shilo (757) within the Aspen Parkland Ecoregion (EGSW 1995 and Smith et al. 1998), which were previously referred to as the Newdale Till Plain, the Brandon Lakes Plain and the Upper Assiniboine Delta (Ehrlich et al. 1956 and 1957). All areas are within the commonly known Grassland Transition Ecoclimatic Region – subregion 2 (Gt2).

Natural vegetation in the area consists of tall prairie grasses, interspersed with aspen-oak groves in the Newdale Till Plain, meadow prairie grasses with aspen-balsam popular groves in the Brandon Lakes Plain, and mixed grass prairie and herbs with scattered stands of mixed woods (e.g., spruce, scrubby aspen-oak groves, green ash, elm, basswood, choke cherry, saskatoon and willow) in the Upper Assiniboine Delta (Ehrlich et al. 1957 and Smith et al. 1998).

The Newdale Till Plain consists of ground moraine with a smooth to undulating topography. The periphery of the plain is incised by many ravines that contain outwash deposits. Some deposits consisit of coarser materials in the south eastern postion in areas with rougher topography (Ehrlich et al. 1957). In the north part of the RM, the surface deposits in the Newdale Till Plain area are strongly calcareous, loam to clay loam glacial till of shale, limestone and granitic rock origin (Figure 2). Most of this area is characterized by the Newdale smooth phase (Ehrlich et al., 1957). The dominant soil texture in this portion of the RM is moderately fine (Map 4).

Smooth lacustrine deposits exist in the Brandon Lakes Plain portion of the RM (Figure 2). The deposit materials covering this area include clays, silts and sands ranging in texture from fine to medium (Map 4). Soil materials in the north portion of the plain are predominantly clay. In the southern portion, materials are silty in texture (Ehrlich et al., 1956 and Ehrlich et al., 1957).

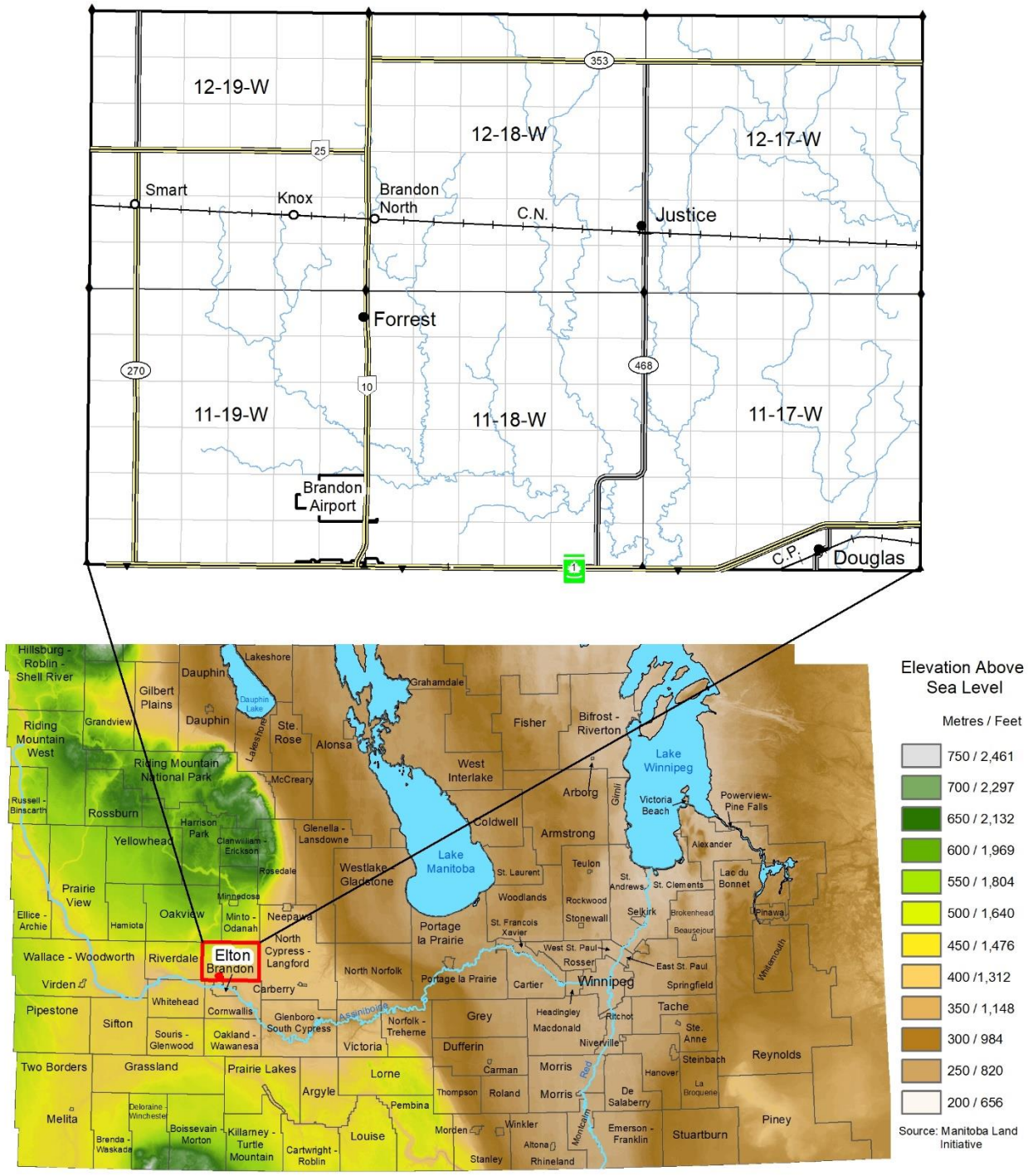


Figure 1: Location of the Study Area: The Rural Municipality of Elton

The Upper Assiniboine Delta is a complex landscape located above the Manitoba Escarpment. It consists of lacustrine and outwash plains and is in the most southeastern corner of the RM of Elton (Figure 2). The lacustrine plain deposits range in texture from coarse to fine. Wind has modified the coarse-texture deposits in the study, resulting in sand dunes. The outwash deposits consist mainly of gravels and very coarse materials (Ehrlich et al. 1957).

1.3 Geology

The underlying bedrock in the RM of Elton is from Cretaceous shale of the Riding Mountain and Vermilion River Formation.

- Riding Mountain Formation includes two kinds of shale 1) Millwood Member –soft green bentonitic shale and 2) Odanah Member – hard grey siliceous shale.

- Vermilion River Formation includes Morden Member (black carbonaceous shale) and Boyne Member (calcareous and carbonaceous shale).

Due to transportation of rock fragments and other materials from glacial activity surface deposits can also contain material from many other rock formations which underlie the Riding Mountain Formation shales. This includes sandstones and other shales from the Cretaceous period, evaporties from the Jurassic period, acidic intrusive rock from the Pre-Cambrian era, limestones and dolostones of the Devonian, Silurian and Ordavician period (Ehrlich et al. 1956 and 1957 and Corkery 1996).

1.4 Soils

As the RM of Elton is located in the Newdale Till Plain, Brandon Lakes Plain, and the Upper Assiniboine Delta (Figure 2), most soils are developed from lacustrine over glacial till (40.5%) and glacial till parent material (35.3%) (Table 1). According to the Canadian System of Soil Classification (Soil Classification Working Group, 1998), the soils are classified as dominantly Orthic Black Chernozems (Newdale and Clementi soil Series) in combination with Rego Black Chernozems (Rufford and Chambers) and Gleyed Rego Black Chernozems (Varcoe and Beresford).

Table 1. Soil Parent Material in the Rural Municipality of Elton

Parent material (0 to 100 cm)	Total area		% of RM
	ha	ac	
Alluvium	657	1,624	1.14
Eolian	11	27	0.02
Lacustrine	11,254	27,809	19.48
Lacustrine over fluvial	1,114	2,752	1.93
Lacustrine over fluvial over till	384	948	0.66
Lacustrine over glacial till	23,413	57,855	40.52
Fluvial	131	323	0.23
Glacial till	20,338	50,257	35.20
Water body, eroded slope, marsh, urban and unclassified	474	1,171	0.82
Total	**57,776**	**142,767**	**100**

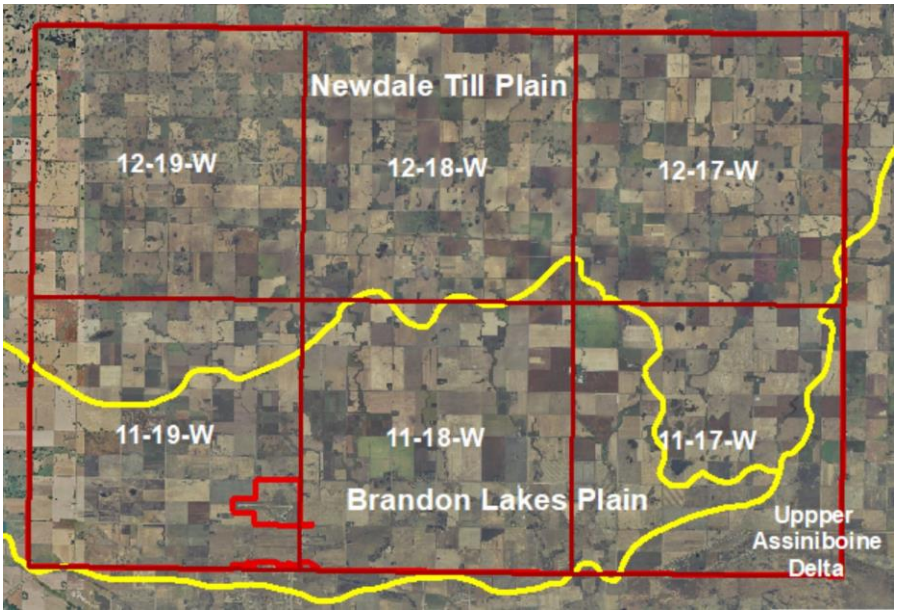


Figure 2. Surface Deposits in the RM of Elton.

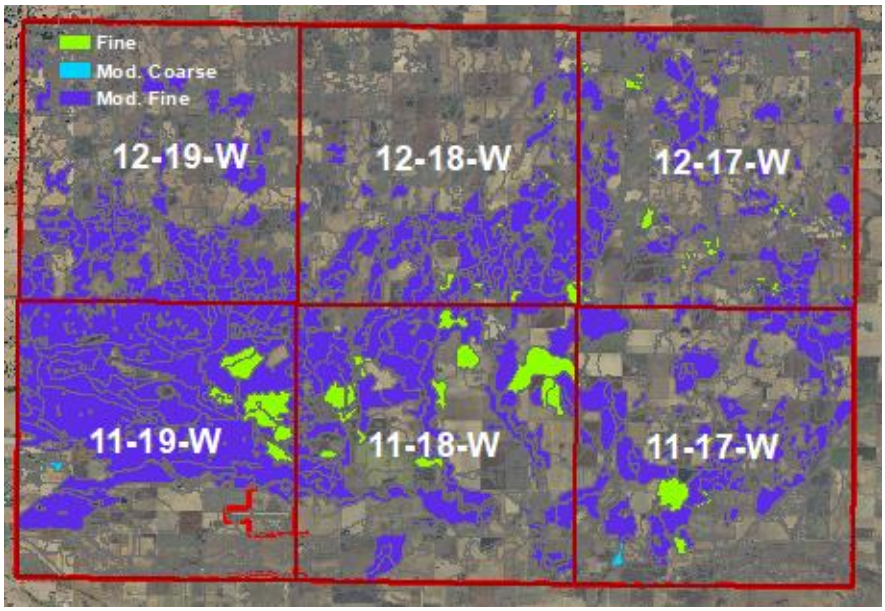


Figure 3. Lacustrine over Glacial Till Distribution in the RM of Elton

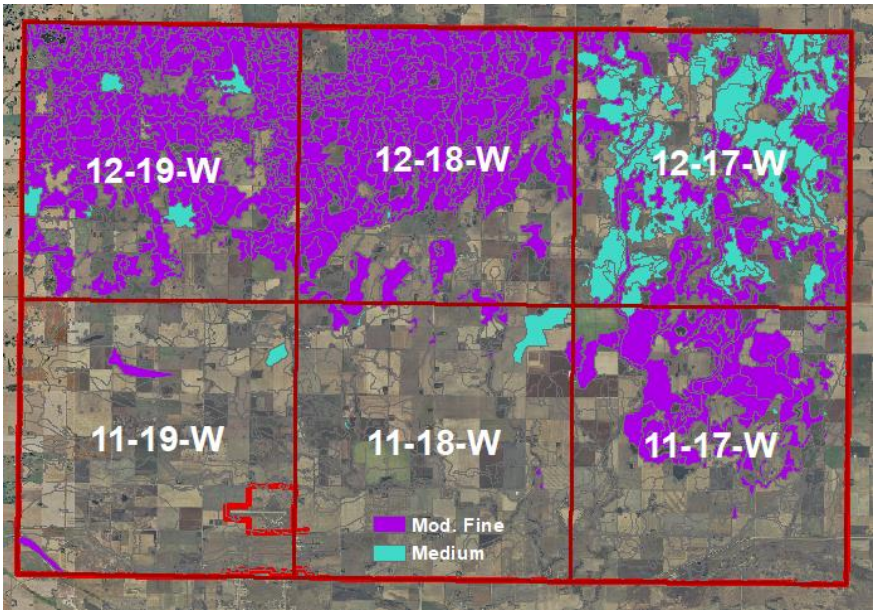


Figure 4. Glacial Till Distribution in the RM of Elton

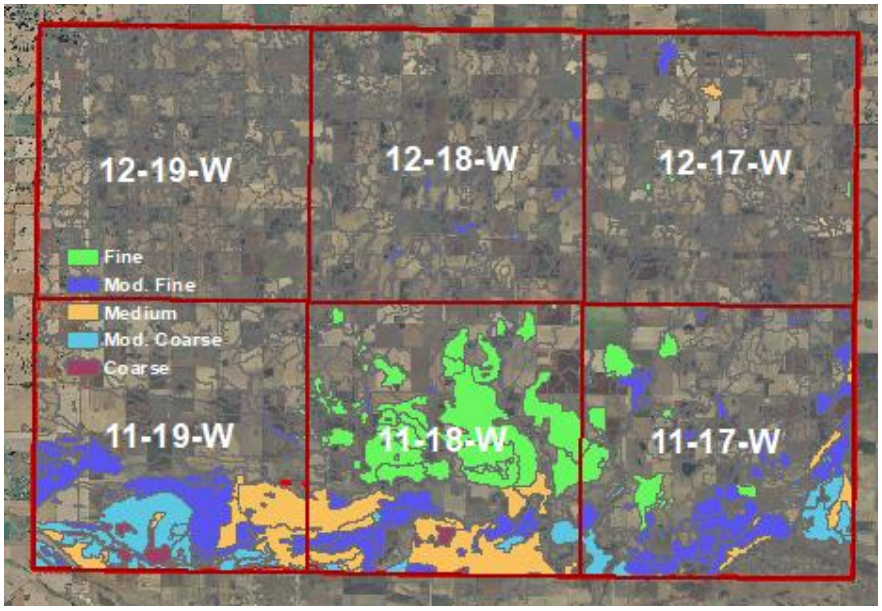


Figure 5. Lacustrine Sediment Distribution in the RM of Elton

Figure 6. Fluvial, Lacustrine over Fluvial and Lacustrine over Fluvial over Glacial Till Desposits in the RM of Elton

The most common soil series developed from lacustrine over glacial till deposits in the RM of Elton are Beresford, Clementi, and Chambers accounting for 15.6, 7.6 and 4.5% of the study area, respectively. All three soil series are moderately fine (SiCL, CL) in texture and are a part of the Beresford Association. These moderately fine lacustrine over glacial till deposits are located mainly on the interface between the Brandon Lakes Plain and Newdale Till Plain (Figure 2 and 3).

Soils developed directly on glacial till in the study area are loamy in texture (moderately fine to medium) and are almost all located within the Newdale Till Plain (Figure 2 and 4). The most common soil series developed from these deposits are all aprt of the Newdale soil association and include Newdale (9.1%), Rufford (8.7%) and Varcoe (6.4%).

Almost all soils developed from deep (>100cm) lacustrine sediments are located within the Brandon Lakes Plain (Figure 2 and 5). Compared to the other types of surface deposits in the RM of Elton, the lacustrine deposits have a wide range in texture, ranging from fine to coarse (Figure 5). Finer textures are localized in the central area of the Brandon Lakes Plain and coarser texture soils are localized on the border between the Brandon Lakes Plain and the Upper Assinboine Delta (Figure 2 and 5). The most common soil series developed from lacrustrine deposits is Sigmund (3%) and is fine in texture (SiC, C). The next most common soils developed from deep lacustrine sediments are the moderately fine textured (CL, SiCL) Prodan (2.6%) and the medium textured (VFSL, L, SiL) Taggart (2.2%).

Fluvial, lacustrine over fluvial and lacustrine over fluvial over glacial till in the RM of Elton are generally localized in the water worked outwash area of the Upper Assiniboine Delta (Figure 2 and 6) covering 2.8% of the study area.

Soils developed from alluvium deposits are located around riverbeds or on terraces above streams and cover 1.1% of the study area. The most common soil series are Basker, Levine and Kerran.

Part 2. Methodology

2.1 Mapping and Map Scale

Detailed soil mapping at a 1:20,000 scale (approx. five cm equals one km) was completed for the Rural Municipality of Elton. Soil profiles were examined to a depth of one metre at sites approximately 160 metres apart along traverses that were spaced approximately 800 metres apart. The direction of each traverse was determined on the basis of enhancing the information that could be derived from the range of soil-landscape variation in each section. Additional soil inspections occurred in complex soil areas to help locate boundaries between different soil series or variable soil phases. This method of surveying provided approximately 25 to 30 inspections per section of land, or a soil inspection density of one site per 10 hectares (25 acres).

Based on all soil and landscape information collected during field inspections, the boundaries delineating various soil series are digitized using Geographic Information Systems (GIS) and three-dimensional viewing software – Summit Lite. This allows higher positional accuracy of soil polygons and contrast features. In the areas where previous soil surveys were done, some of the old soil polylines were revised based on new images and updated information.

2.2 Map Units

The information from soil inspection sites forms the basis for delineating soil boundaries on a map. Each geographic area enclosed by these soil boundaries is referred to as a soil polygon. Each soil polygon is named according to the soil series that are present in the polygon.

A soil series is defined as a naturally occurring soil body, so that any profile within that body has a similar number and arrangement of horizons whose colour, texture, structure, consistence, reaction and composition are within a narrowly defined range. If a soil has properties that vary slightly from the prescribed range of the series, a soil series **variant** is established.

A soil polygon can contain up to three named soil series. The collective name or label of a soil polygon is referred to as a map unit.

A map unit represents portions of the soil landscape that have characteristics and properties varying within narrow limits that are determined by the intensity of the survey. The map unit contains one or more soils or non-soils plus a certain proportion of unnamed and un-described inclusions. Map units are delineated on the basis of the types and relative proportions of their soils or non-soils, as well as on the basis of external criteria, such as slope, stoniness, erosion or salinity. Examples of a non-soil include water or bedrock.

2.3 Simple and Compound Map Units

There are two major types of map units: simple and compound. The difference between a simple and compound map is the proportion and contrast of their components.

A **Simple Map Unit** contains predominantly one soil or non-soil. The predominant component comprises at least 65%, with up to 35% of non-limiting, similar components (components that are alike in most properties and behaviour), or up to 25% of non-limiting, dissimilar components (components that do not affect management of the map unit, but have a significant number of properties that vary from the predominant component), or up to 15% of limiting, dissimilar components (components which have many contrasting properties and usually affect management differently).

A **Compound Map Unit** contains predominantly more than one soil or non-soil (or a combination of both). The proportions of the two major components may vary, from one considerably exceeding the other, to both being approximately equal. Complementary to the definition of a single map unit, the proportions of components vary according to

their areal extent and contrasting characteristics, as they may affect soil management or use. If other components are similar and non-limiting, no single component represents more than 65%; or if other components are dissimilar and non-limiting, no single component represents 75% or more; or if other components are dissimilar and limiting, no single component represents 85% or more.

For the purpose of describing compound map units, components are considered dominant if they occupy over 40% of the unit. They are considered significant between 15 and 40%, and minor if they occupy less than 15%. Minor components are described only if they are highly contrasting.

2.4 Phases

It is often desirable to indicate a condition or quality of soil property or landscape feature that deviates significantly from the normal definition of map units, using a map unit symbol. These variations or phases of soil properties and landscape features, varying from delineation to delineation, significantly affect soil behaviour and land management or use.

Soil properties that are commonly used as phase criteria include texture, depth, surface peat, salinity and physical disruption. Properties of land that are used include slope, wind and water erosion, stoniness, rockiness and altered drainage.

The four properties are erosion, slope class, degree of stoniness and salinity. The degree or magnitude of each is designated in Figure 7.

The convention used to indicate these features in the map symbol is as follows:

If none of the above properties are observed to be significant, the map symbol representing the normal or unaffected soil series is used alone without modifiers (example in Figure 7).

If one or more phase features are recognized, the appropriate letter or number is placed below the soil series symbol in one of four designated locations in the map unit symbol. The designated order is erosion, slope class, stoniness and salinity. If a particular feature is not observed to be significant, an x is used in its appropriate designated location in the map symbol (Figure 7).

A simple map unit in Figure 7 can be interpreted as a Carvey soil (peaty variant) that has no erosion (x), is nearly level (b), and has no stones (x) or salinity (x).

An example of a compound unit (Figure 7) is as follows: 50% consists of Fairland (FND^5) series having no erosion (x), has very gently sloping topography (c), is moderately stony at the surface (2), and has no salinity (x), 30% Traverse (TAV^3) series that is slightly eroded (1), very gently sloping (c), has no stones (x) and is non-saline (x), and 20% Ramada (RAM^2) series having no erosion (x), is nearly level in topography (b), has no stones (x) and no salinity (x) (Figure 7). If all the phases and features have an x designation, the four (x) phases are not shown in the map symbol (e.g., Miniota (MXI) in Figure 7).

2.5 Sampling and Analyzing

Over 300 soil surface and subsurface samples were collected and analyzed for texture (particle size), pH, organic carbon, electrical conductivity (EC) and calcium carbonate content. Soil cation exchangeable capacity (CEC) was also determined in detailed soil profile samples.

The brief methodologies of lab analyses used to determine soil characteristics are:

- Calcium carbonate: Calcimeter using 1M HCl
- CEC: Ammonia electrode
- EC: Saturated paste
- pH: 2:1 water to soil ratio
- Organic carbon: Walkley-Black method
- Particle size: Pipette method

Soil series maps contain labels similar to those shown in the pale brown boxes below. A description of each kind of label is indicated below.

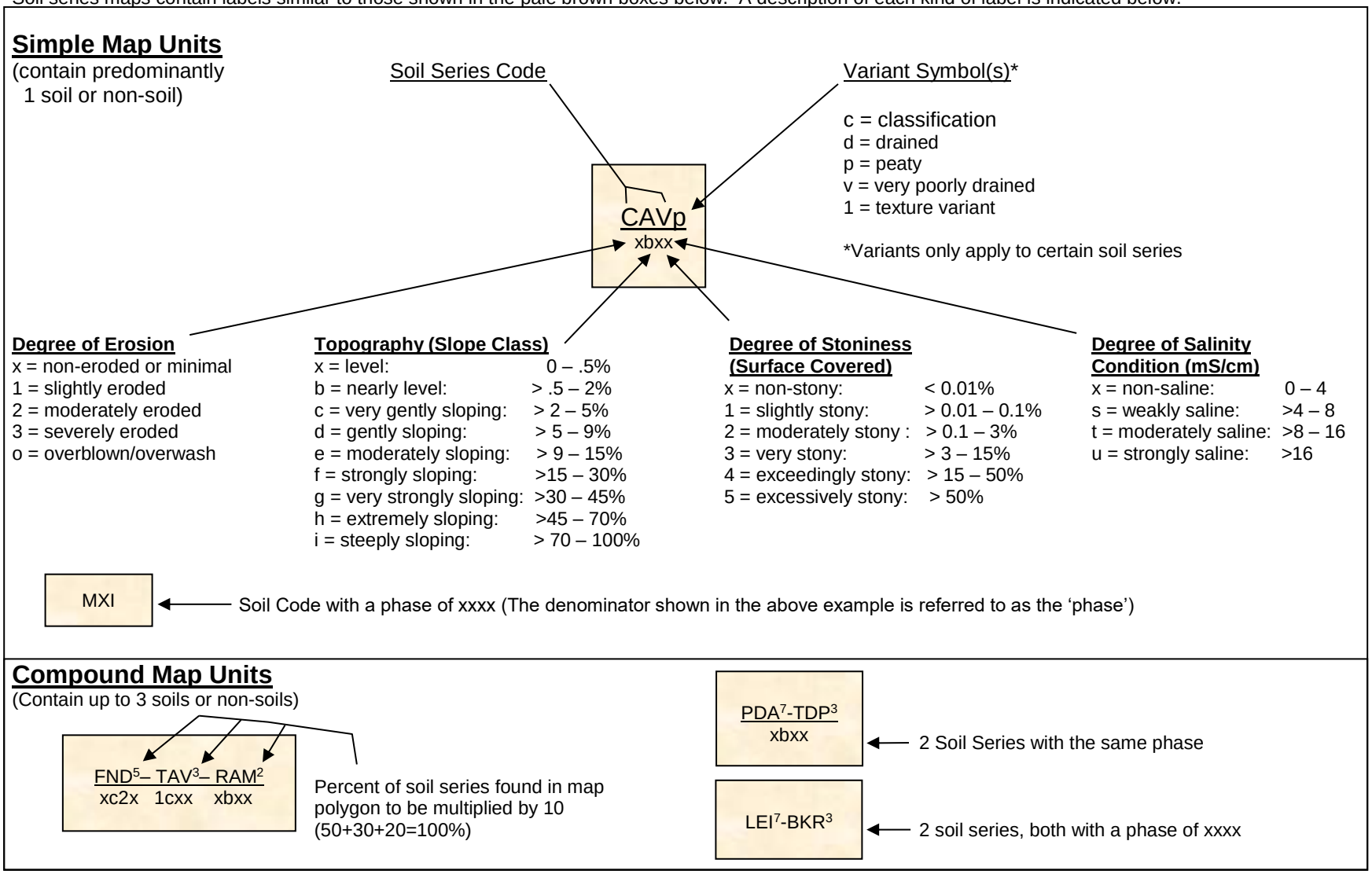


Figure 7: Map Unit Symbol

Part 3 Development and Classification

3.1 Introduction

This section of the report describes the main characteristics of the soils and their relationship to the factors of soil development. Soil development is related to the regional climate and the degree of leaching, translocation and accumulation of soluble and colloidal fractions of the soil. Soil drainage also plays a significant role in soil development. Soils in the RM of Elton have developed under a cool subhumid boreal climate (Grassland Transition Ecoclimatic Region), which provides sufficient moisture and heat for development of aspen-oak groves, tall prairie grasses and associated herbs. Consequently, the majority of soils in the area are Chernozemic soils.

3.2 Classification

Soils in the study area are classified according to the *Canadian System of Soil Classification* (SCWG, 1998). This system is hierarchical, employing five levels of generalization or categories of classification. Beginning with the most generalized, these categories are the order, great group, subgroup, family (association) and series. The classification is based on measurable soil properties that can be observed in the field, or can be inferred from other properties observable in the field. The properties selected as criteria for the higher categories are the result of soil genesis or of factors that affect soil genesis. Properties used to differentiate soils at the lower levels of family and series affect management. The five levels of generalization are defined as follows:

Order – Soil orders are defined on the basis of soil properties of the pedon that reflect the nature of the soil environment and the effects of the dominant soil-forming process. An example is a Chernozem, in which soils with dark coloured surface horizons developed under sub-humid climate and dominantly grassland environments.

Great Group – Each order is subdivided into great groups, based on differences in the strength of dominant processes or a major contribution of a process, in addition to a dominant one. Such processes result in particular kinds, arrangements and degrees of expressions of pedogenic horizons. An example is a Luvic Gleysol, in which the dominant process is considered to be gleying, but clay translocation is also a major process.

Subgroup – Subgroups are subdivisions of great groups, and are defined according to the kind and arrangement of horizons that indicate the conformity to the central concept of the great group (e.g., Orthic Luvic Gleysol, these soils have the general properties of the Gleysolic order and properties of the Luvic great group, with an organic or mineral-organic surface horizons).

Family – Families are established within a subgroup, based on the similarity of physical and chemical properties that affect management. The properties that are considered important for recognizing families are particle size distribution, mineralogy, soil climate, soil reaction and thickness of solum.

Series – The series consists of soils that formed in a particular kind of material and have horizons with colour, texture, structure, consistency, thickness, reaction and chemical composition that are similar in differentiating characteristics and in arrangement in the soil profile.

The classification of soils in the study area in relation to parent material, texture and drainage is listed in Table 2. The proportion of soils in terms of land area and surface texture in the RM of Elton is shown in Table 3. Each individual soil series is described in detail in Appendix 2.

Table 2. Relationship between Soil Series, Drainage, Parent Material and Classification (Grassland transition subregion 2, Gt2-North)

Drainage	Soil Classification	Till (L, CL, SCL)			Lacustrine over Till			
		Loamy Extremely calcareous Till (L, CL, SiCL)	Loamy Mixed, Calc.	Loamy Or CL, SiCL) (shaly)	(FS, LFS) over Mixed Till or Extr. Calc.Till	(LVFS, FSL) over Mixed Till or Extr. Calc.Till	Fine Loamy (CL, SiCL) over Mixed Till	Clayey (SiC, C) over Mixed Till
Well to Mod. Well	Orthic Regosol	Madill (MXH)					Roddan (ROD)	
	Orthic Black Chernozem	Hilton (HIT)	Newdale (NDL)	Lenore (LNO)	Kirkness (KKS)	Lockhart (LKH)	Clementi (CLN)	Everton (EVO)
	Calc. Black Chernozem	Woodfield (WDF)	Cordova (CVA)				Kleysen (KYS)	
	Rego Black Chernozem	Bermont (BMN)	Rufford (RUF)				Chambers (CBS)	
	Orthic Dark Gray Chernozem							
Imperfectly	Gleyed Black Chernozem		Moore Park (MPK)				Cobfield (CBF)	Justice (JUC)
	Gl. Eluv. Black Chernozem		Angusville (ANL)					
	Gl. Calc. Black Chernozem		Lavinia (LAV)					
	Gl. Rego Black Chernozem	Barwood (BWO)	Varcoe (VRC)		Killeen (KLL)	Lindstrom (LDM)	Beresford (BSF)	Forrest (FRT)
	Gl. Dark Gray Chernozem		Petlura (PTU)					
Poorly	Orthic Gleysol		Hamiota (HMI)					
	Rego Humic Gleysol	Hickson (HKS)	Drokan (DRO)			Lonery (LOE)	Vodroff (VFF)	Fenton (FET)
	Humic Luvic Gleysol		Penrith (PEN)					

Soil texture abbreviations: C = clay, Co = coarse, F = fine, H = heavy, L = loam(y), M = medium, S = sand(y), Si = silt(y), and V = very.

Table 2. Relationship between Soil Series, Drainage, Parent Material and Classification (Grassland transition subregion 2, Gt2) (cont'd)

Drainage	Soil Classification	Lacustrine over Outwash			Outwash	Lacustrine over Outwash over Till	Fluvial over Till	Alluvium	
		MS, FS, LS over (CoS, MS)	(VFS, LVFS, SL, FSL) over (S & Gravel)	(L, SiL CL, SiCL) over (S + Gravel)	Sand and Gravel	(L, SiL, SiCL, CL) over (S & Gravel) Over (L, CL, SiCL)	(S & Gravel) over (L, CL, SiCL)	(VFSL, L, SiL, CL, SiCL)	(SiC, C)
Well to Mod. Well	Cumulic Regosol							Mowbray (MOW)	Manson (MXD)
	Orthic BL Chernozem	Wheatland (WHL)	Miniota (MXI)	Croyon (CYN)	Dorset (DOT)	Jaymar (JAY)			
	Calc. BL Chernozem				Marringhurst (MRH)	Dogand (DGA)	Chater (CXW)		
	Rego BL Chernozem		Ashmore (AHO)	Zarnet (ZRT)	Floors (FLS)				
Imperfectly	Gleyed Cumulic Regosol							Levine (LEI)	Assiniboine (ASB)
	Gleyed BL Chernozem	Hughes (HGH)	Wytonville (WVI)	Druxman (DXM)	Dexter (DXT)				
	Gleyed El. Bl. Chernozem					Longdens (LGD)			
	Gleyed Rego Bl. Chernozem	Gendzel (GDZ)	Kilmury (KUY)	Capell (CXT)	Mansfield (MFI)	Melland (MXT)	Barager (BAA)		
Poorly	Rego Humic Gleysol	Lowroy (LOW)	Bornett (BOR)	Carvey (CAV) Carvey, peaty (CAVp)	Fortina (FTN) Fortina, peaty (FTNp)	Marsden (MDN)		Basker (BKR) Basker, peaty (BKRp)	Kerran (KRN)

Table 2. Relationship between Soil Series, Drainage, Parent Material and Classification (Grassland transition subregion 2, Gt2) (cont'd)

Drainage	Soil Classification	Eolian	Lacustrine							
		Coarse (FS, LFS)	Coarse (FS, LFS)	Mod. coarse (VFS, LVFS, FSL)	Medium (VFSL, L, SiL)	Mod. Fine (CL, SiCL)	Fine (SiC, C)	(VFSL, L, SiL) over (FS, LFS, VFS, LVFS)	(CL, SiCL) over (FS, LFS, VFS, LVFS)	(SiC, C) over (FS, LFS, VFS, LVFS)
Well to Mod. Well	Orthic Regosol	Shilox (SHX)	Arizona (AIZ)	Brownridge (BWD)	Knolls (KLS)	Barren (BAE)				
	Orthic BL Chernozem		Stockton (SCK)	Prosser (PSE)	Fairland (FND)	Ramada (RAM)	Janick (JIK)	Glenboro (GBO)	Wellwood (WWD)	
	Calc. BL Chernozem				Traverse (TAV)	Rempel (RMP)				
	Rego BL Chernozem		Cactus (CCS)	Porple (POR)	Durnan (DRN)	Carroll (CXF)	Bankton (BAO)			
	Orthic Dark Gray Chern.		Dobbin (DOB)	Halstead (HAT)	Pollen (POL)	Firdale (FIR)				
Imperfectly	Gleyed Regosol	Onahan (ONH)								
	Gleyed BL Solonetz									Oliver (OIV)
	Gleyed BL Chernozem		Lavenham (LVH)	Gateside (GTD)	Torcan (TOC)	Charman (CXV)	Harding (HRG)	Petrel (PTR)	Oberon (OBR)	
	Gleyed El. Bl. Chernozem					Gregg (GRG)				
	Gleyed Rego Bl. Chernozem		Hummerston (HMO)	Pleasant (PLE)	Taggart (TGR)	Prodan (PDA)	Sigmund (SGO)	Grover (GRO)	Crookdale (CKD)	
	Gl. D.Gray Chernozem			Bone (BNE)		Danlin (DLN)				
Poorly	Rego Humic Gleysol	Mockry (MKY)	Sewell (SEE)	Poolex (POX)	Vordas (VDS)	Tadpole (TDP)	Lowton (LWN)	Grayson (GYS)	Sutton (SXP)	Landseer (LSR)
Very poorly	Terric Mesisol		Perillo (PER)[@]							
	Typic Mesisol		Xavier (XVI)[@]							

@ PER & XVI are organic soils. They were also found in the Grassland Transition, subregion 4 (Gt4) and Low Boreal subhumid subregion 2 (LBs2) from previous soil survey reports.

Table 3. Soil Series, Drainage, and Surface Texture in the RM of Elton

Soil Name	Soil Symbol	Soil Drainage	Surface Texture	Textural Group of Soil Profile	Total area		% of RM
					ha	ac	
Ashmore	AHO	Well	Very fine sand to FSL	Mod. coarse over very coarse	30	75	0.05
Arizona	AIZ	Rapid	Fine sand to LFS	Coarse	11	28	0.02
Angusville	ANL	Imperfect	Loam to clay loam	Medium to mod. fine	174	431	0.30
Assiniboine	ASB	Imperfect	Clay	Fine	1	2	0.01
Bankton	BAO	Well	Clay	Fine	89	221	0.15
Basker	BKR	Poor	Loam to clay loam	Medium to mod. fine	326	806	0.56
Bermont	BMN	Well	Loam to clay loam	Medium to mod. fine	2,386	5,895	4.13
Beresford	BSF	Imperfect	Clay loam	Moderately Fine	9,121	22,538	15.79
Barwood	BWO	Imperfect	Loam to clay loam	Medium to mod. fine	664	1,640	1.15
Carvey**	CAV	Poor	Clay loam	Moderately Fine	286	706	0.49
Cobfield	CBF	Imperfect	Clay loam	Mod. fine	1,198	2,961	2.07
Chambers	CBS	Well	Clay loam	Moderately Fine	2,610	6,451	4.52
Cactus	CCS	Well	Loamy fine sand	Coarse	31	76	0.05
Crookdale	CKD	Imperfect	Clay loam	Mod. fine over coarse to mod. coarse	263	649	0.45
Clementi	CLN	Well	Clay loam	Moderately Fine	4,395	10,861	7.61
Cordova	CVA	Well	Clay loam	Moderately Fine	951	2,350	1.65
Carroll	CXF	Well	Clay loam	Mod. fine	106	262	0.18
Capell	CXT	Imperfect	Loam to clay loam	Medium to mod. fine over very coarse	250	617	0.43
Charman	CXV	Imperfect	Clay loam	Mod. fine	402	994	0.70
Croyon	CYN	Well	Loam to clay loam	Medium to mod. fine over very coarse	119	294	0.21
Dogand	DGA	Well	Loam to clay loam	Medium over very coarse over mod. fine	17	42	0.03
Dorset	DOT	Rapid	Loamy coarse sand	Coarse	87	215	0.15
Durnan	DRN	Well	Loam	Medium	87	215	0.15
Drokan	DRO	Poor	Clay loam	Moderately Fine	1,307	3,229	2.26
Druxman	DXM	Imperfect	Loam to clay loam	Medium to mod. fine over very coarse	9	23	0.02
Everton	EVO	Well	Clay	Fine over mod. fine	738	1,823	1.28
Fenton	FET	Poor	Clay	Fine over mod. fine	202	500	0.35
Fairland	FND	Well	Loam	Medium	428	1,057	0.74
Forrest	FRT	Imperfect	Clay	Fine	1,038	2,565	1.80
Glenboro	GBO	Well	Loam	Medium over coarse or mod. coarse	197	486	0.34
Gendzel	GDZ	Imperfect	Fine sand to LFS	Coarse over very coarse	2	5	0.01
Gregg	GRG	Imperfect	Clay loam	Mod. fine	21	51	0.04
Grover	GRO	Imperfect	Loam	Medium over coarse to mod. coarse	179	441	0.31
Gateside	GTD	Imperfect	Very fine sand to FSL	Mod. coarse	564	1,393	0.98
Grayson	GYS	Poor/very poor	Loam	Medium over coarse to mod. coarse	15	38	0.03
Hilton	HIT	Well	Loam to clay loam	Medium to mod. fine	672	1,661	1.16

* LFS = Loamy fine sand; FSL = fine sandy loam; LVFS =loamy very fine sand.

**A peaty variant is also included.

Table 3. Soil Series, Drainage, and Surface Texture in the RM of Elton (cont'd)

Soil Name	Soil Symbol	Soil Drainage	Surface Texture	Textural Group of Soil Profile	Total area		% of RM
					ha	ac	
Hickson	HKS	Poor	Loam to clay loam	Medium to mod. fine	43	107	0.07
Harding	HRG	Imperfect	Clay	Fine	337	832	0.58
Jaymar	JAY	Well	Loam to clay loam	Medium over very coarse over mod. fine	175	431	0.30
Janick	JIK	Well	Clay	Fine	571	1,412	0.99
Justice	JUC	Imperfect	Clay	Fine over mod. fine	516	1,274	0.89
Knolls	KLS	Well	Loam	Medium	17	41	0.03
Kerran	KRN	Poor	Clay	Fine	4	11	0.01
Kilmury	KUY	Imperfect	Very fine sand to FSL	Mod. coarse over very coarse	52	128	0.09
Kleysen	KYS	Well	Clay loam	Mod. fine	1,029	2,543	1.78
Lavinia	LAV	Imperfect	Loam to clay loam	Medium to mod. fine	11	27	0.02
Lindstrom	LDM	Imperfect	Fine sandy loam to LVFS	Mod. coarse over medium to mod. fine	23	58	0.04
Levine	LEI	Imperfect	Loam to clay loam	Medium to mod. fine	326	805	0.56
Lockhart	LKH	Well	Fine sandy loam to LVFS	Mod. coarse over medium to mod. fine	15	38	0.03
Lavenham	LVH	Imperfect	Fine sand to LFS	Coarse over mod. fine	60	147	0.10
Lowton	LWN	Poor	Clay	Fine	249	615	0.43
Marsden	MDN	Poor	Loam to clay loam	Medium over very coarse over mod. fine	68	168	0.12
Mansfield	MFI	Imperfect	Sand & gravel	Very coarse	11	26	0.02
Moore Park	MPK	Imperfect	Loam to clay loam	Medium to mod. fine	21	52	0.04
Marringhurst	MRH	Rapid	Sand & gravel	Very coarse	33	82	0.06
Miniota	MXI	Well	Very fine sand to FSL	Mod. coarse over very coarse	152	376	0.26
Melland	MXT	Imperfect	Loam to clay loam	Medium over very coarse over mod. fine	124	307	0.21
Newdale	NDL	Well	Loam to clay loam	Medium to mod. fine	5,286	13,063	9.15
Oberon	OBR	Imperfect	Clay loam	Mod. fine over coarse to mod. coarse	349	862	0.60
Prodan	PDA	Imperfect	Clay loam	Mod. fine	1,499	3,703	2.59
Penrith	PEN	Poor	Loam	Medium	7	17	0.01
Perillo	PER	Very poor	Mesic	Fen peat over Medium	96	236	0.17
Pleasant	PLE	Imperfect	Very fine sand to FSL	Mod. coarse	192	475	0.33
Porple	POR	Well	Very fine sand to FSL	Mod. coarse	9	22	0.02
Poolex	POX	Poor	Very fine sand to FSL	Mod. coarse	16	40	0.03
Prosser	PSE	Well	Very fine sand to FSL	Mod. coarse	28	68	0.05
Petrel	PTR	Imperfect	Loam	Medium over coarse to mod. coarse	1	2	<0.01
Ramada	RAM	Well	Clay loam	Mod. fine	903	2,232	1.56
Rempel	RMP	Well	Clay loam	Mod. fine	0	1	<0.01

Table 3. Soil Series, Drainage, and Surface Texture in the RM of Elton (cont'd)

Soil Name	Soil Symbol	Soil Drainage	Surface Texture	Textural Group of Soil Profile	Total area		% of RM
					ha	ac	
Rufford	RUF	Well	Loam to clay loam	Medium to mod. fine	5,057	12,497	8.75
Stockton	SCK	Well	Fine sand to LFS	Coarse	84	207	0.14
Sigmund	SGO	Imperfect	Clay	Fine	1,713	4,233	2.96
Shilox	SHX	Rapid	Fine sand to LFS	Coarse	11	27	0.02
Sutton	SXP	Poor	Clay loam	Mod. fine over coarse to mod. coarse	139	344	0.24
Traverse	TAV	Well	Loam	Medium	18	45	0.03
Tadpole	TDP	Poor	Clay loam	Mod. fine	620	1,533	1.07
Taggart	TGR	Imperfect	Loam	Medium	1,294	3,197	2.24
Torcan	TOC	Imperfect	Loam	Medium	383	947	0.66
Vordas	VDS	Poor	Loam	Medium	45	111	0.08
Vodroff	VFF	Poor	Clay loam	Mod. fine	2,526	6,243	4.37
Varcoe	VRC	Imperfect	Loam to clay loam	Medium to mod. fine	3,704	9,154	6.41
Woodfield	WDF	Well	Loam to clay loam	Medium to mod. fine	55	135	0.09
Wheatland	WHL	Rapid	Fine sand to LFS	Coarse over very coarse	143	353	0.25
Wytonville	WVI	Imperfect	Very fine sand to FSL	Mod. coarse over very coarse	15	38	0.03
Wellwood	WWD	Well	Clay loam	Mod. fine over coarse to mod. coarse	228	563	0.39
Xavier	XVI	Very poor	Mesic	Fen peat	12	29	0.02
Zarnet	ZRT	Well	Loam to clay loam	Medium to mod. fine over very coarse	55	137	0.10
Marsh Complex	$MH	Very poor	Loam	Medium	346	855	0.60
Eroded Slope Complex	$ER	--	--	--	3	8	0.01
Unclassified	$UL	--	--	--	30	75	0.05
Water	$ZZ	--	--	--	94	233	0.16
Total					**57,776**	**142,767**	**100**

Part 4 Agricultural Use and Management Interpretations of Soils

4.1 Introduction

These sections provide predictions for the performance or soil suitability ratings for various land uses, based on soil and landscape characteristics, laboratory data and soil behaviour under specified conditions of land use and management. Suitability ratings or interpretations for various land use applications are intended to serve as guides for planners and managers.

The management of soil and landscape data using GIS technology enables rapid and more quantitative analysis of natural soil variability than is possible using manual techniques. The areal distribution of various soil components and properties that occur in complex landscapes can be highlighted in a mapped formto help plan and manage the soil resource. Such single factor maps and interpretative maps illustrate the distribution of individual soil properties and indicate the degree of soil limitation or potential for agricultural use and environmental applications.

A series of derived and interpretive maps are included in this section to assist in the interpretation of the soil resource information for the study area. The GIS uses the 1:20, 000 scale soil map and related soil analysis and landscape information to generate these colour thematic maps.

The maps portray a selection of individual soil properties or landscape conditions for map unit delineations. Combinations of soil properties or landscape features affecting land use and management are derived as specific interpretations. Derived maps portray specific interpretations, based on the dominant condition in each map polygon.

Soil properties determine to a great extent the potential and limitations for both dryland and irrigation agriculture. In this section, interpretive soil information is provided for agricultural land use evaluations, such as soil capability for agriculture and irrigation suitability.

4.2 Soil Capability for Agriculture

The soil capability rating for agriculture is based on an evaluation of both the soil characteristics and landscape conditions that influence the soil suitability and limitations for agricultural use (Anon, 1965) (Appendix 1, Section A).

The class indicates the general suitability of the soils for agriculture. The first three classes are considered capable of sustained production of common field crops. The fourth is marginal for sustained arable agriculture. The fifth is suitable only for improved permanent pasture. The sixth is capable of use only for native pasture, while the seventh class is for soils and land types considered incapable of use for arable agriculture or permanent pasture.

Soil capability subclasses identify the soil properties or landscape conditions that may limit use or be a hazard. The various kinds of limitations recognized at the subclass level are defined in Section B of Appendix 1.

Class 1 soils in the map area have level to very gently sloping topography. They are deep, well to moderately well drained, have moderate water holding capacity and have no major limitations for crop use.

Class 2 soils have moderate limitations that reduce the choice of crops or require moderate conservation practice. They include the imperfectly drained soils with a wetness limitation (2W), and the well-drained and imperfectly drained soils having a topographic limitation (2T). The two to five per cent slopes associated with the 2T soils may increase cultivation costs over that of a

smooth landscape and increase the risk of water erosion.

Class 3 soils have moderately severe limitations that restrict the range of crops or require moderate conservation practices. These soils usually associate with gently sloping topography (five to nine per cent) resulting in a moderate risk of water erosion.

Class 4 soils have significant limitations that restrict the choice of crops or require special conservation practices. Most Gleysols with improved drainage are generally grouped in this class. The timing of cultivation or choice of crops is severely limited because of the wetness limitation.

Class 5 soils have very severe limitations that restrict their capability to produce perennial forage crops. This class of soils usually has excess water (5W) or lack of moisture limitation (5M), including the lower, depressional areas of the poorly drained soils.

Class 6 soils have an extremely severe limitation due to excess wetness (6W), limited moisture (6M), or soil erosion (6E), which restricts their capability to produce perennial forage crops.

Class 7 soils have no capability for arable agriculture. However, these soils may have high capability for native vegetation species and habitat for waterfowl and wildlife.

A guideline table of dryland agricultural capability, as affected by soil characteristics and landscape, is listed in Table A1 of Appendix 1.

The agricultural capability of lands in the RM of Elton is summarized in Table 4. The majority of the land in the RM is grouped into Class 2 (70%). Class 3 and 5 lands are next, comprising 11.3 and 10.4% of the study area. Class 1 land covers nearly seven per cent, mainly located in the south eastern portion of the RM, with a few small pockets in the north western portion (Map 1). Classes 4, 6, 7 and organic lands account for only a small portion, totalling less than one per cent for each class.

The most limiting factors in Class 2 lands in the RM of Elton are topography (2T, 2MT, 2TD, 2TE, 2WT), comprising 20,603 ha (50,912 ac) and excess moisture (2W) covering 17,608 ha (43,781 ac).

Class 3 lands in the study area are mainly due to a salinity limitation (3N), comprising 5,307 ha (13,114 ac). These lands are mainly located in the southwestern portion of the RM (Map 1).

Soils in Class 4 cover a small area (less than one per cent) in the RM and are mainly limited by lack of moisture (4M).

Soils grouped into Class 5 are largely due to excess water (5W), resulting in an area of 5,393 ha (13,326 ac) scattered in small pockets throughout the RM.

Class 6 and 7 lands occupy less than one per cent of the study area and are mainly limited by excess water (6W and 7W). Organic soils in the RM of Elton make up less than one per cent of the land area as well.

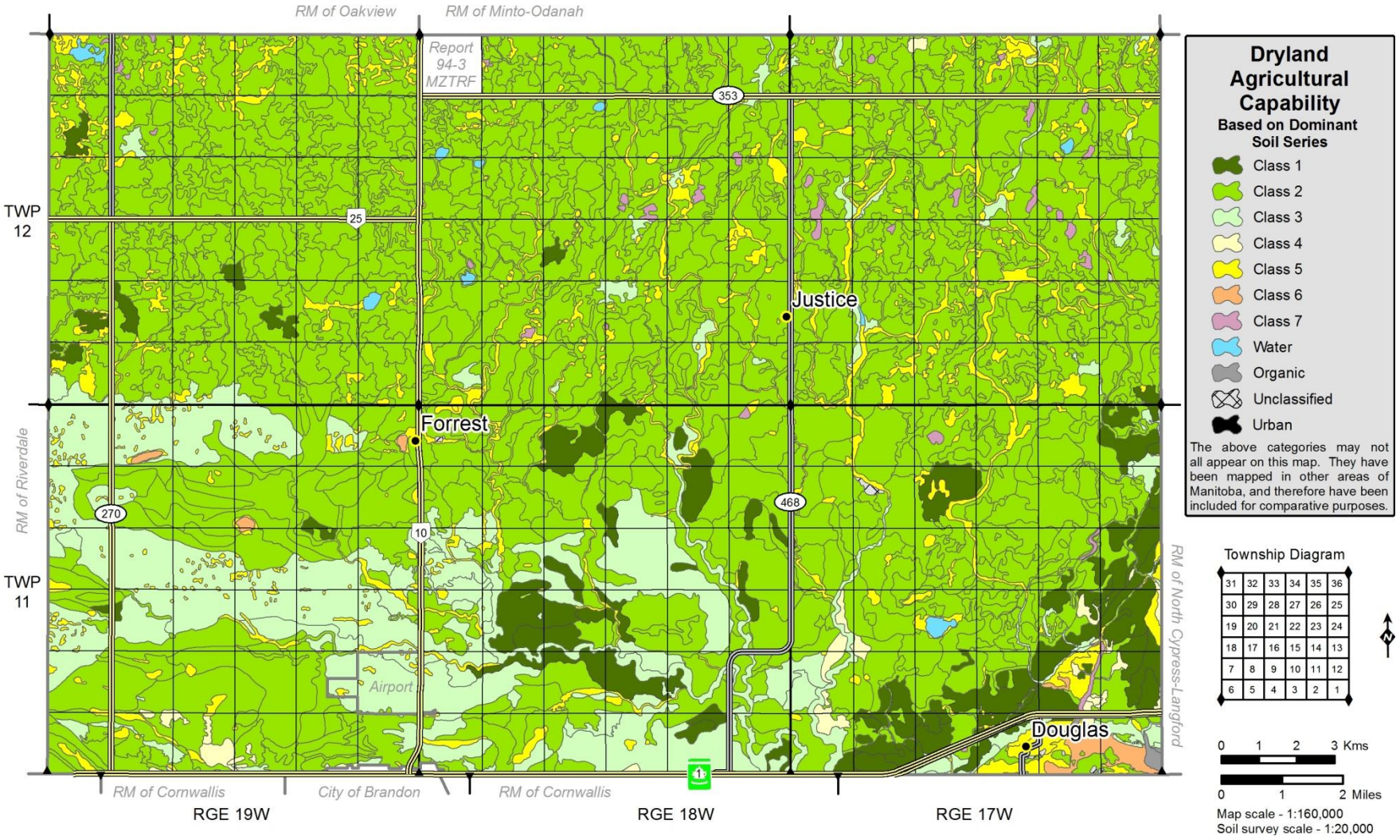
Overall, for the land area in the RM, the most limiting factor is excess moisture (W) alone or in combination with other limitations consisting of 23,977 ha (59,247 ac) or 41% of the land area (Table 4).

An interpretative map (Map 1) depicts the rating of the dominant soil series and landscape features for each polygon. The nature of the subclass limitations and the rating of subdominant soil and landscape components are not shown at the scale of this map, but they are presented in detail in Table A2 of Appendix 1. A poster-sized agricultural capability map (1:20,000) is also included with this report.

Table 4. Dryland Agricultural Capability of Land in the RM of Elton

Agricultural Capability Class		Total area		% of RM
		ha	ac	
1		4,008	9,903	6.94
2 (69.57)	2D	73	181	0.13
	2M	1,209	2,989	2.09
	2MT	107	265	0.19
	2T	16,931	41,837	29.30
	2TD	16	40	0.03
	2TE	31	77	0.05
	2W	14,090	34,818	24.39
	2WT	3,518	8,693	6.09
	2X	4,218	10,423	7.30
Subtotal		40,193	99,323	69.57
3 (11.29)	3E	17	41	0.03
	3I	327	807	0.57
	3M	467	1,155	0.81
	3MT	2	6	0.00
	3MW	60	147	0.10
	3N	5,307	13,114	9.19
	3T	299	739	0.52
	3TE	40	99	0.07
Subtotal		6,519	16,108	11.29
4 (0.57)	4M	308	761	0.53
	4ME	2	4	<0.01
	4T	24	61	0.04
Subtotal		334	826	0.57
5 (10.38)	5IW	331	817	0.57
	5M	259	639	0.45
	5ME	16	39	0.03
	5W	5,393	13,326	9.33
Subtotal		5,999	14,821	10.38
6 (0.26)	6E	3	8	0.01
	6M	11	27	0.02
	6W	132	327	0.23
Subtotal		146	362	0.26
7	7W	346	855	0.60
Organic	O3W	107	265	0.19
Unclassified		30	75	0.05
Water		94	233	0.16
Grand Total		**57,776**	**142,767**	**100**

Map 1. Dryland Agricultural Capability Map of the RM of Elton



4.3 Irrigation Suitability

The rating guidelines in this section are derived from *An Irrigation Suitability Classification System for the Canadian Prairies* (ISC, 1987). The irrigation suitability rating of the soils is based on soil and landscape characteristics. It does not consider factors such as method of water application, water availability, water quality or the economics of this type of land use.

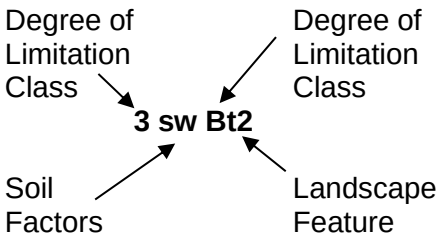
Soil properties considered important for evaluating irrigation suitability are texture, soil drainage, depth to water table, salinity and geological uniformity.

Landscape features considered important for rating irrigation suitability are topography and stoniness.

The irrigation suitability of the soil and landscape characteristics in the study area assists in making initial irrigation plans. The next step involves on site field investigation to examine the depth to water table, salinity and geological uniformity to a depth of three m. Drainability, drainage outlet requirement, organic matter status and potential for surface crusting are other factors to consider. This assessment also considers potential impact of irrigation on non-irrigated areas, as well as on the irrigated area.

The most limiting soil property and landscape features are combined to determine the placement of a land area in one of 16 classes of irrigation suitability, which are grouped and described by four ratings: **Excellent, Good, Fair** and **Poor** (Table A3 of Appendix 1). The guidelines of assessing irrigation suitability are listed in Table A4 and A5 of Appendix 1, respectively.

An example of an irrigation suitability class rating with subclass limitations is shown as:



A maximum of three codes is used to identify the subclass rating. Salinity (s) and drainage class (w) are soil factors that contribute to the soil rating of 3 or Moderate. The landscape limitation due to complex topography (t2) is Slight or (B). As the soil factor (3 or Moderate) is more limiting than the landscape feature (B or Slight), the general rating for this land area (3B) is fair (Appendix 1, Table A3 to A5).

A summary of soils and their interpretive classification for irrigation suitability is presented in Table 5. The subdominant soil series and phases are considered when analyzing the data. Majority of the land area (80%) in the RM of Elton falls into two irrigation suitability classes; Good and Fair. Basically, there are no severe limiting factors for soils in the Good irrigation class, except soil saturated hydraulic conductivity and its drainability (2kx A), or in combination with topography (2kx Bt2). Soils that fall into the Fair suitability class are limited due to lack of drainage (3w A).

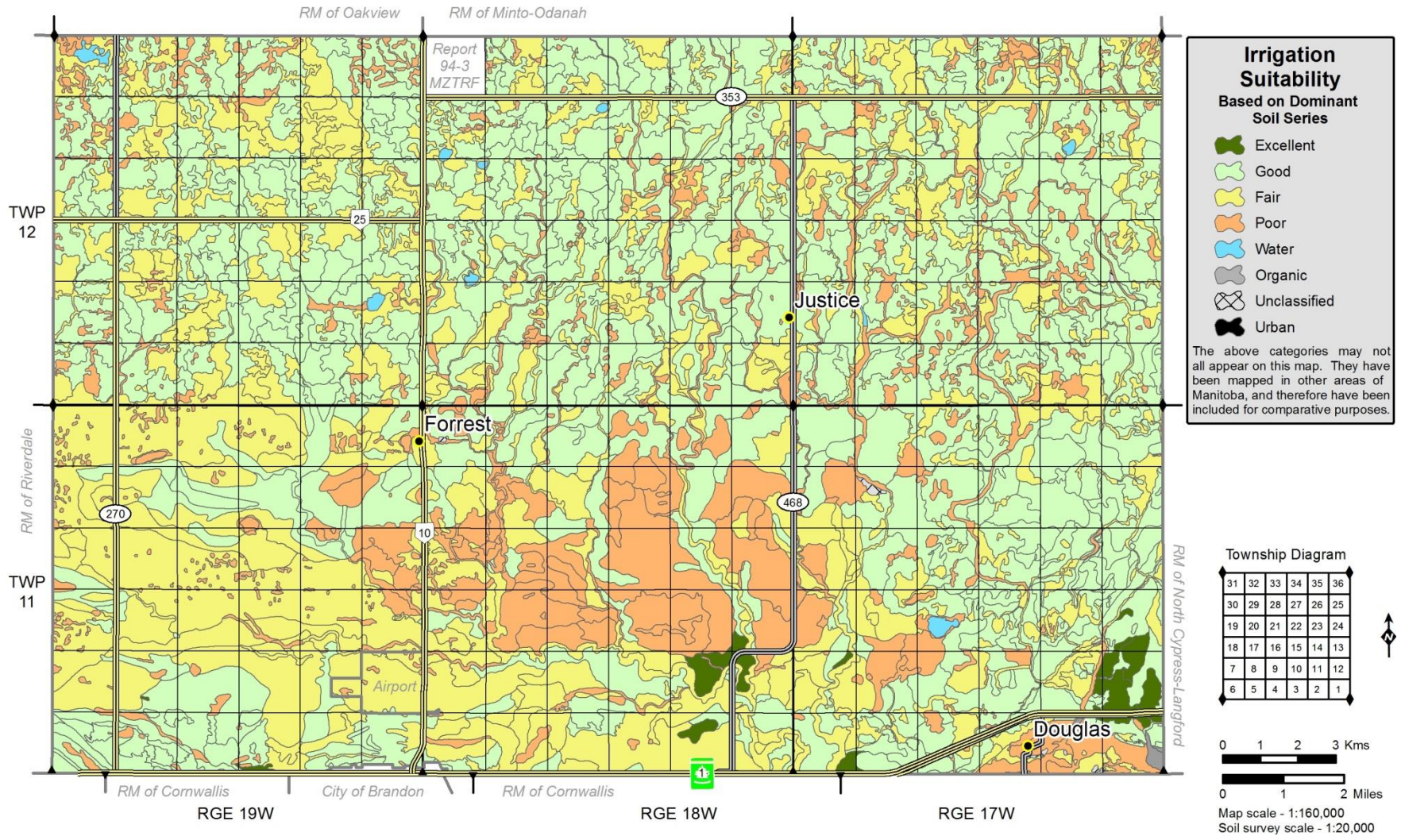
The land that falls into the Poor suitability class are mainly located in TWP 11, where Fine soil textures are dominant. This land is mainly located in the Brandon Lakes Plain landform, with small pockets throughout the RM as well (Figure 2 and Map 4).

Irrigation suitability classes shown on Map 2 are based on the dominant soil for each polygon.

Table 5. Soil Irrigation Suitability in the RM of Elton

Class (%)	Soil & landscape features	Total area		% of RM
		ha	ac	
Excellent (0.81)	1 A	467	1,153	0.81
Good (45.08)	1 Bt2	276	681	0.48
	2gm A	86	213	0.15
	2gm Bt2	48	120	0.08
	2k A	1,075	2,657	1.86
	2k Bt2	95	235	0.16
	2kx A	5,690	14,061	9.85
	2kx Bt2	16,509	40,794	28.6
	2m A	339	839	0.59
	2m Bt2	148	365	0.26
	2mw A	110	272	0.19
	2mw Bt2	17	41	0.03
	2w A	1,615	3,990	2.8
	2w Bt2	21	53	0.04
	2x Bt2	15	38	0.03
Fair (34.88)	1 Ct2	24	60	0.04
	2gm Ct2	40	98	0.07
	2k Ct2	67	166	0.12
	2kx Ct2	243	600	0.42
	2m Ct2	18	44	0.03
	3kw A	48	118	0.08
	3kw Bi	1	2	0.01
	3kw Bt2	147	363	0.25
	3m A	85	210	0.15
	3m Bt2	69	171	0.12
	3m Ct2	11	27	0.02
	3mw Bt2	2	5	0.00
	3s A	976	2,412	1.69
	3sw A	3,475	8,586	6.01
	3sw Bt2	10	26	0.02
	3w A	11,019	27,228	19.0
	3w Bi	326	805	0.56
	3w Bt2	3,082	7,616	5.33
	3w Ct2	29	72	0.05
	3wx A	21	52	0.04
	3wx Bt2	3	6	0.01
Poor (19.63)	4k A	1,947	4,812	3.37
	4k Bt2	344	850	0.60
	4kw A	451	1,115	0.78
	4kw Ci	4	11	0.01
	4kx A	2,600	6,424	4.50
	4kx Bt2	111	273	0.19
	4m A	97	241	0.17
	4m Bt2	33	83	0.06
	4m Ct2	3	8	0.01
	4w A	4,951	12,234	8.57
	4w Bt2	123	303	0.21
	4w Ci	326	806	0.56
	4wx Di	346	855	0.60
Organic (0.19)	0 A	107	265	0.19
Unclassified land, urban and water		125	308	0.22
Total		**57,776**	**142,767**	**100**

Map 2. Irrigation Suitability of the RM of Elton



4.4 Soil Suitability for Irrigated Potato Production

An evaluation of soil properties and landscape features was used to generate a five-class rating of land for irrigated potato production. Soil properties considered were texture, soil drainage, salinity and sodicity. Landscape features considered were topography and stoniness. The most suitable soil and landscape conditions occur in **Class 1** and the least desirable conditions occur in **Class 5**. Details regarding the criteria applied in the suitability rating are described in Tables A6 and A7 of Appendix 1.

Assumptions:

This evaluation examines soil and landscape factors that are important for irrigated production of potatoes for processing. Production of seed and table potatoes with irrigation may not be affected to the same degree by soil conditions such as stoniness and texture.

Stoniness hinders soil preparation, interferes with harvesting, and increases the chances of potato bruising during harvest.

Deep, well-drained sandy loam to loam soils exhibit favorable properties for the production of high-quality potatoes. Clay soils with impeded internal soil drainage have a severe limitation to potato production because of reduced oxygen supply and increased incidence of fungal diseases. An increased risk of delayed spring tillage and planting and crop harvesting due to wet conditions can occur on fine textured soils.

Slope or topography reduces uniform water infiltration and increases the potential for soil erosion and nutrient loss.

This evaluation of soil and landscape properties does not incorporate additional factors that must be assessed for sustainable irrigated production of potatoes.

The environmental impact of intensive management practices on soil and water quality, the supply of good quality water, and the suitability of climatic conditions for optimum potato production must all be evaluated.

Integration of related databases in a GIS environment can be used to create a map that depicts the rating of the dominant soil and landscape feature for each soil polygon. The nature of the subclass limitations and the rating of subdominant soil and landscape components are not shown at this scale, but are indicated in Table A2 of Appendix 1.

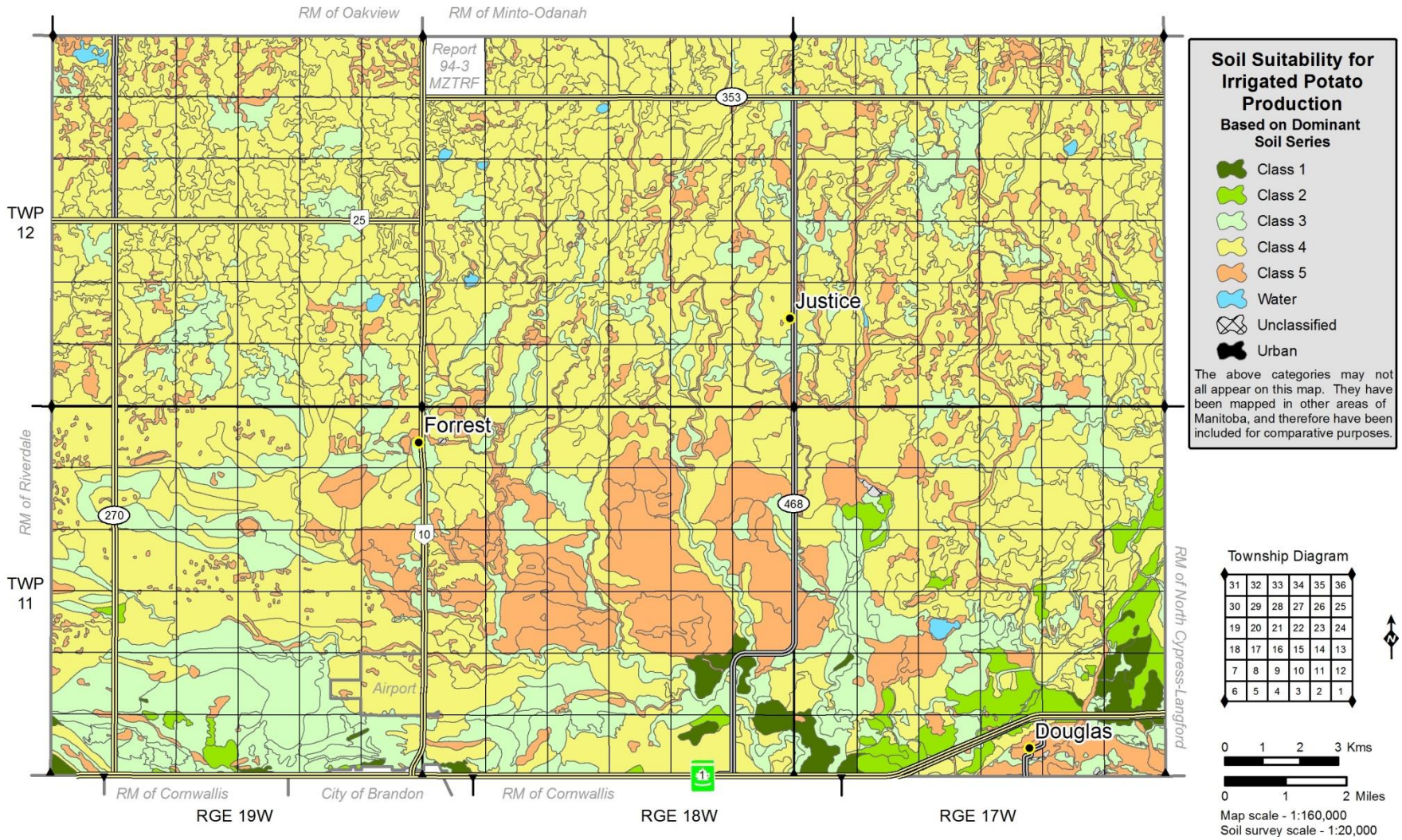
Less than five per cent of the lands in the RM of Elton are suitable for irrigated potato production (Classes 1 and 2) (Table 6). These lands are mainly located in the southeastern portion of the RM (Map 3). Three quarters of the land (76%) in the RM is not suitable for irrigated potato production (Classes 4 and 5).

Table 6. Soil Irrigation Suitability for Potato Production in the RM of Elton

Potato Suitability Class	Total area		% of RM
	ha	ac	
Class 1	742	1,834	1.28
Class 2	1,285	3,174	2.22
Class 3	11,598	28,660	20.07
Class 4	32,542	80,412	56.32
Class 5	11,484	28,379	19.88
Water	94	233	0.16
Unclassified	30	75	0.05
Total	**57,776**	**142,767**	**100**

An interpretative map (Map 3) illustrates the rating of the dominant soil series and landscape features for each polygon.

Map 3. Soil Suitability for Irrigated Potato Production in the RM of Elton



4.5 Soil Texture

Mineral particles in soil are grouped according to size into sand (two to 0.05 mm in diameter), silt (0.05 to 0.002 mm) and clay (less than 0.002 mm). The proportion of individual mineral particles present in a soil is referred to as texture. Soil texture is described by means of 13 textural classes, defined according to the relative proportions of sand, silt and clay (Figure 8). The presence of larger particles (diameter is greater than two mm) in soil is recognized as:

Gravelly – particles ranging from 0.2 to 7.5 cm in diameter

Cobbly – rock fragments ranging from 7.5 to five cm in diameter

Stony – rock fragments ranging from 25 to 60 cm in diameter, or if flat, 38 to 60 cm long

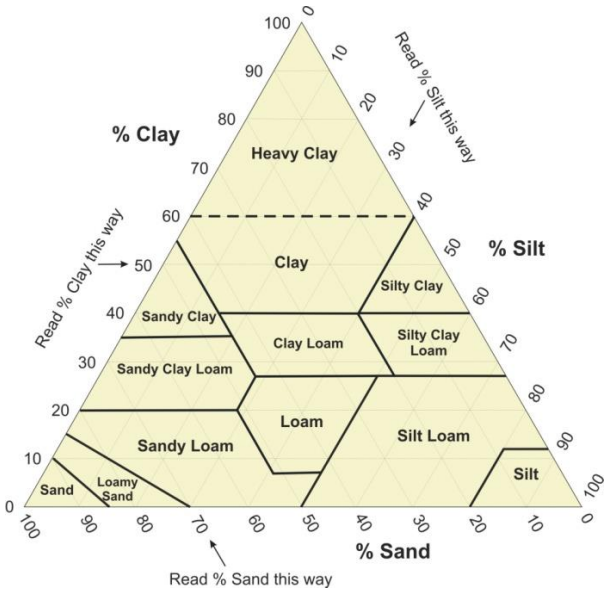


Figure 8. Soil Texture Triangle

Soil texture strongly influences the soil's ability to retain moisture, its fertility and its ease or difficulty of cultivation. Water moves easily through coarse-textured (sandy) soils, so little moisture is retained and they dry out more quickly than fine textured (clay) soils. Sandy soils do not retain plant nutrients as well as clay soils and are lower in natural fertility. Sandy soils often are characterized by loose or single grained structure, which is very susceptible to wind erosion. Clay soils have a high proportion of very small pore spaces that hold moisture tightly. They are usually fertile, because they are able to retain plant nutrients. Clay soils transmit water very slowly, so these soils are susceptible to excess soil moisture conditions. Textural classes are grouped as coarse, medium and fine with sub groups and classes (Table 7).

Table 7. Soil Texture Groups

Texture group		Texture	
		Class	Symbol
Coarse	Very coarse	Very coarse sand	VCoS
		Coarse sand	CoS
		Medium sand	S or MS
	Coarse	Fine sand	FS
		Loamy coarse sand	LCoS
		Loamy sand	LS or LMS
		Loamy fine sand	LFS
	Mod. coarse	Very fine sand	VFS
		Loamy very fine sand	LVFS
		Coarse sandy loam	CoSL
		Sandy loam	SL or MSL
		Fine sandy loam	FSL
Medium	Medium	Very fine sandy loam	VFSL
		Loam	L
		Silt loam	SiL
		Silt	Si
Fine	Mod. fine	Sandy clay loam	SCL
		Clay loam	CL
		Silty clay loam	SiCL
	fine	Sandy clay	SC
		Silty clay	SiC
		Clay	C
	Very fine	Heavy clay	HC

Particle size analysis conducted among 309 samples randomly collected from the A horizon in the study area, 178 samples were clay loam, accounting for just over half (58%) of the samples collected (Table 8). Loam, silty clay loam, and silty clay soil surface textures consist of 12, 8.7 and five per cent, respectively of the samples collected.

Table 8. Lab Results of Soil Surface Texture in the RM of Elton

Texture	# of samples	% of total
Clay	24	7.77
Silty Clay	16	5.18
Clay Loam	178	57.60
Silty Clay Loam	27	8.74
Sandy Clay Loam	11	3.56
Silty Loam	3	0.97
Loam	37	11.97
Fine Sandy Loam	5	1.62
Medium Sandy Loam	3	0.97
Loamy Medium Sand	2	0.65
Loamy Coarse Sand	1	0.32
Total	**309**	**100**

Based on field and soil polygon data, the different soil surface texture, texture groups and their proportions for the RM of Elton are listed in Table 9. Soil texture determined in the laboratory and those delineated in the field and soil polygons, showed a similar trend with the majority (73%) of the land area in Elton having a clay loam (CL) surface texture, followed by loam (L) (10%) and silty clay (SiC) (seven per cent).

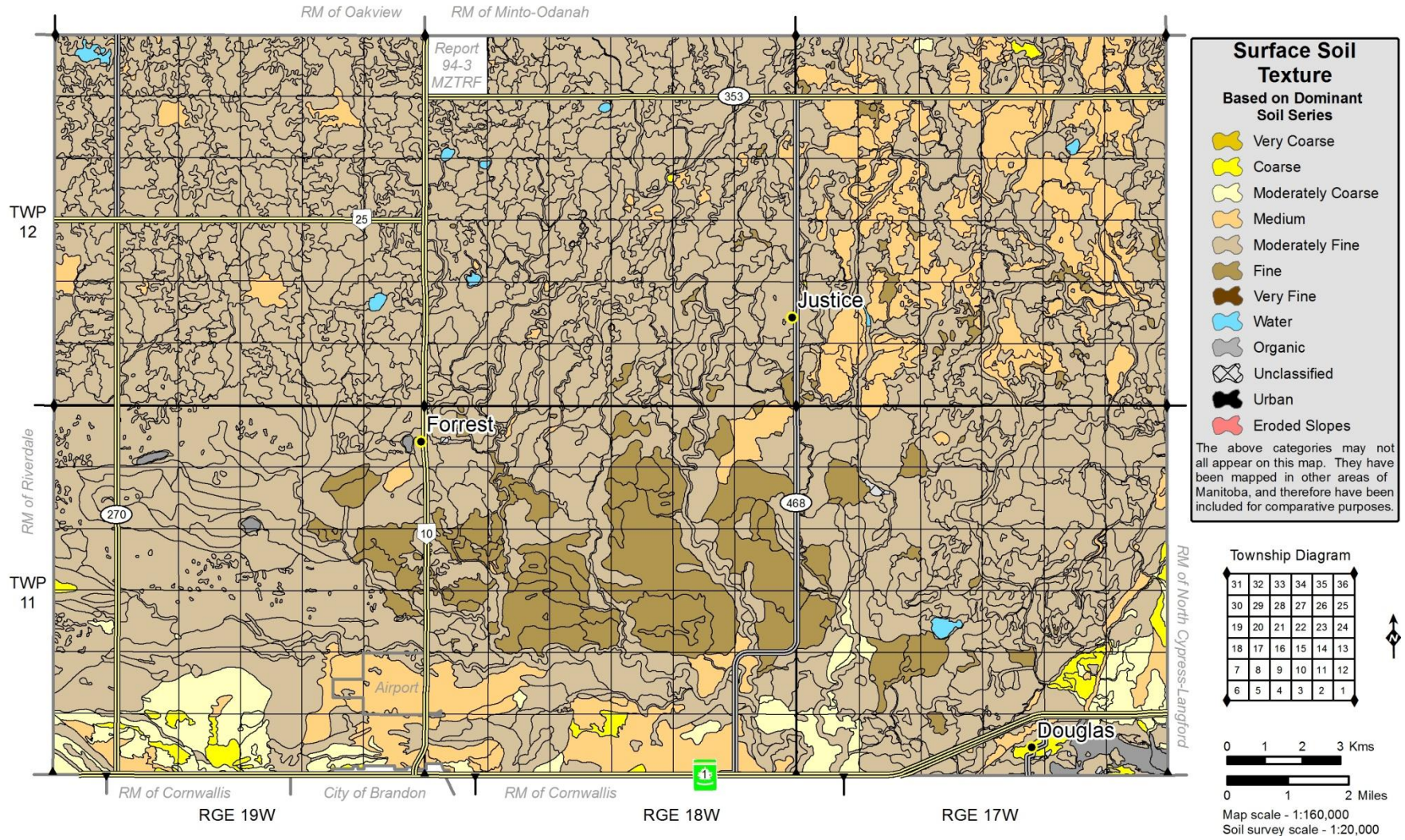
Surface soil texture, shown in Map 4, illustrates the textural group of the dominant soil for each polygon.

Table 9. Soil Surface Texture and their Proportions in the RM of Elton

Texture group	Texture	Total area		% of RM
		ha	ac	
Very coarse	GRSL*	33	82	0.06
Coarse	FS	11	27	0.20
	LCoS	230	568	0.40
	LFS	185	458	0.32
	LS	13	31	0.02
Mod. coarse	FSL	1,643	4,060	2.84
	LVFS	54	133	0.09
	SL	204	504	0.35
Medium	VFSL	383	947	0.66
	L	5,963	14,735	10.3
	SiL	166	409	0.29
Mod. fine	CL	42,234	104,361	73.1
	SCL	543	1,343	0.94
	SiCL	326	806	0.56
Fine	C	1,246	3,080	2.16
	SiC	4,212	10,408	7.29
Organic	M	202	499	0.35
Unclassified, eroded slope, urban & water		128	316	0.22
Total		**57,776**	**142,767**	**100**

* GRSL = gravelly sandy loam.

Map 4. Soil Surface Texture in the RM of Elton



4.6 Soil Drainage

Soil drainage refers to the frequency and duration of periods when the soil is free of saturation. Excessive water content in soil limits the free movement of oxygen and decreases the efficiency of nutrient uptake. Delays in spring tillage and planting are more frequent in depressional and imperfectly to poorly drained areas of a field. Improved surface drainage and underground tile drainage are management considerations that can reduce excessive moisture conditions in soils. The majority of poorly drained soils remain in the native state, supporting vegetation associated with wetlands and marsh. Five soil drainage classes are described below.

Rapidly drained - Water is removed from the soil rapidly in relation to supply. Excess water flows downward if underlying material is pervious. Subsurface flow can occur on steep slopes during heavy rainfall. Soils have low water storage capacity and are usually coarse in texture.

Well-drained - Excess water is removed from the soil, readily flowing downward into underlying pervious material or laterally as subsurface flow.

Imperfectly drained - Water is removed from the soil sufficiently slowly in relation to supply to keep the soil wet for a significant part of the growing season. The sources of moisture include precipitation and groundwater.

Poorly drained - Water is removed so slowly in relation to supply that the soil remains wet for a comparatively large part of the time when the soil is not frozen. The main water source is subsurface flow and groundwater, in addition to precipitation.

Very poorly drained - Water is removed from the soil so slowly that the water table remains at, or on, the surface for the greater part of the time that the soil is not frozen. Excess water is present in the soil throughout most of the year.

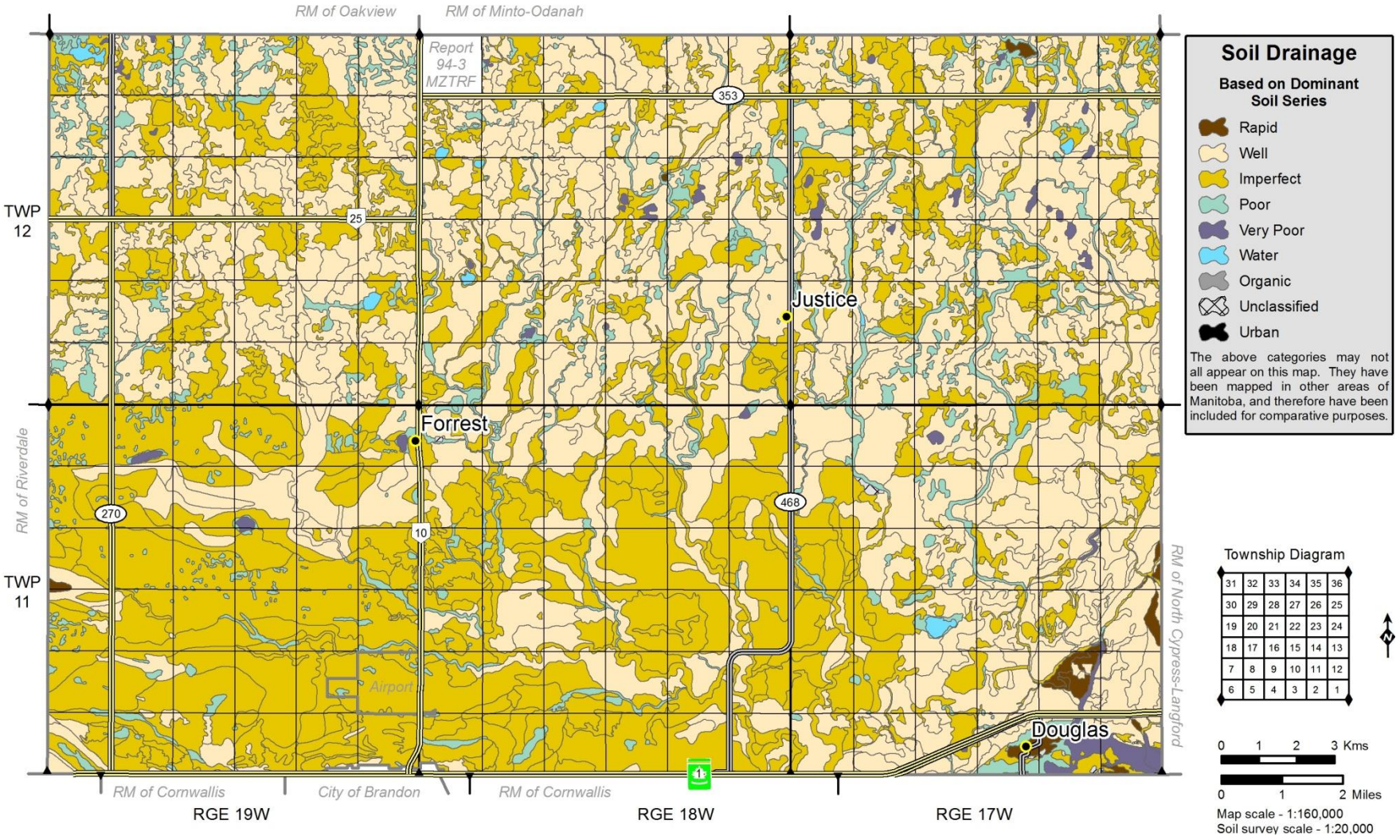
Soil drainage is affected by factors such as landscape, surface texture and land use practices. Table 10 indicates that almost 90% of the RM of Elton is well or imperfectly drained. The imperfectly drained soils are mainly concentrated in the south western part of the RM where it lies within the Brandon Lakes Plain landarea (Figure 2 and Map 5). Poorly drained soils, scattered throughout the RM, account for almost 10% of the land area. Rapid and very poorly drained soils account for less than five per cent.

Table 10. Soil Drainage Classes in the RM of Elton

Drainage Class	Total area		% of RM
	ha	ac	
Rapid	288	713	0.50
Well	26,539	65,578	45.93
Imperfect	24,516	60,579	42.43
Poor	5,723	14,143	9.91
Very Poor	586	1,447	1.01
Water	94	233	0.16
Unclassified	30	75	0.05
Total	**57,776**	**142,767**	**100**

Soil Drainage classes shown on Map 5 are based on the dominant soil for each polygon.

Map 5. Soil Drainage in the RM of Elton



4.7 Soil Erosion

Erosion is defined as the detachment and movement of soil particles by water, wind, ice or gravity. Soil erosion by water is the main concern on undulating and hummocky soil landscapes in the agricultural region of Manitoba. Soil loss resulting from rainfall-runoff is usually due to combinations of raindrop splash, sheet, rill, gully and channel bank erosion. Sheet and rill erosion are usually least apparent in the landscape, but often the most damaging, since it causes gradual thinning of the soil profile over the entire slope. Sheet erosion tends to occur on upper slopes and ridges, whereas the more visible rills form in the area of concentrated runoff on mid and lower slopes. The deposition of eroded soil at the base of slopes or in ditches constitutes additional losses and costs attributed to erosion.

Wind erosion has its largest influence on sandy (coarse) textured, cultivated soils on relatively level landscapes. However, all soils are subject to wind erosion if vegetation or crop residues do not cover the soil surface. Continuous cropping and minimum or zero tillage to maximize residue cover will reduce the risk of erosion. Row crops, such as potatoes, produce low amounts of residue. Therefore, seeding annual crops, such as fall rye and winter wheat, will help to protect the soil surface during the critical post-harvest period, until the establishment of groundcover the following spring.

The impact of soil erosion on soil loss and productivity is not easily measured. In addition to nutrient loss from soil erosion, there is physical deterioration of the soil, resulting in lower water holding and infiltration capacity, and poorer surface structure. Crops are then susceptible to more frequent and severe water stress and lower crop yields occur.

The ratings of soil erosion are generally classified into three categories:

Slightly eroded – soil with a sufficient amount of the A horizon removed that ordinary tillage will bring up and mix the B-horizon or lower horizons.

Moderately eroded – soil with the entire A horizon and a part of the B or lower horizons removed.

Severely eroded – soils that have practically all of the original surface soil removed and the tilled layer consists mainly of C-horizon material. This condition occurs on knolls and steep upper slope positions.

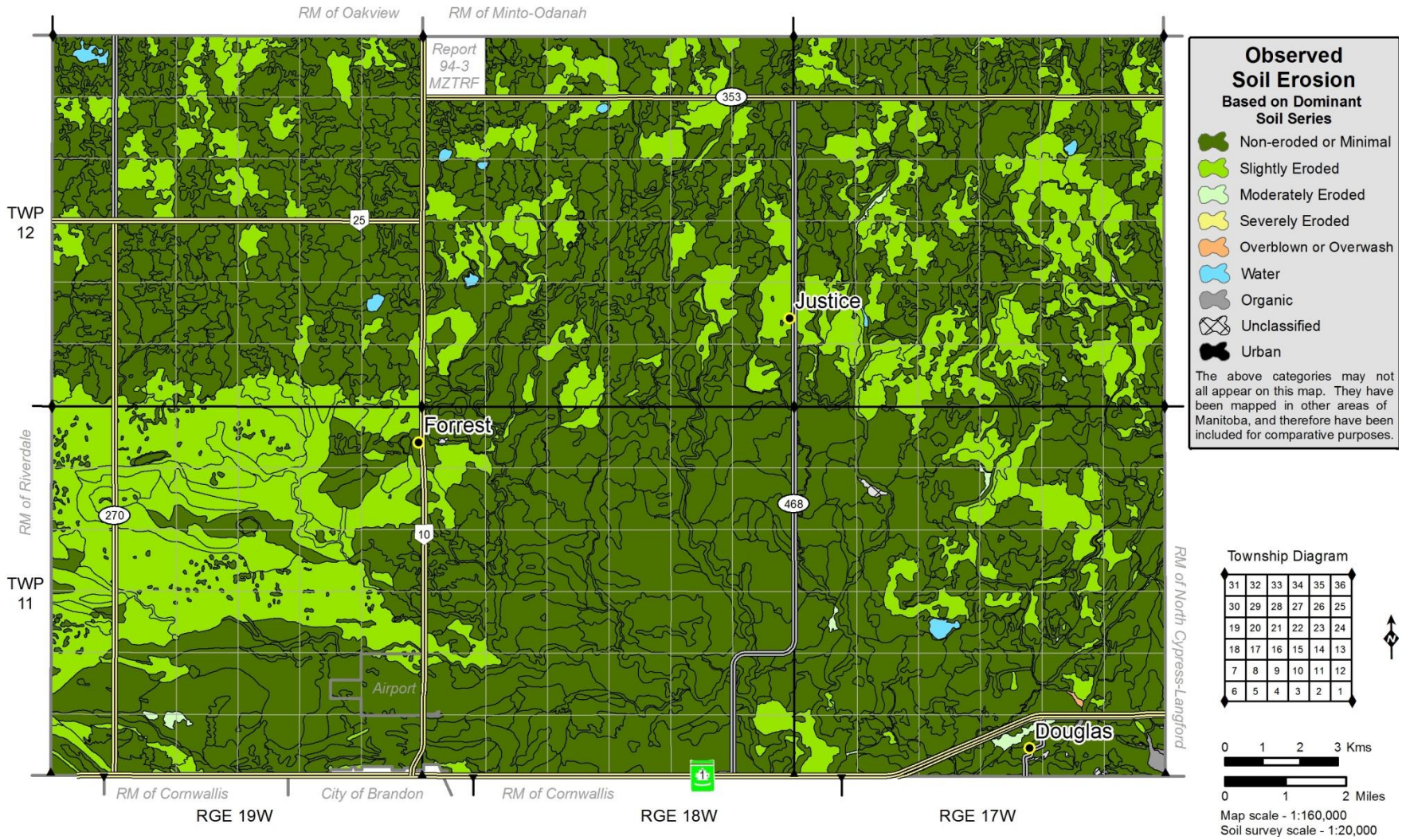
Soil erosion in the RM of Elton is not severe with 79% being non-eroded or minimally eroded. Twenty per cent of the land area is slightly eroded. The remaining land area (less than one per cent) falls into the remaining erosion classes (Table 11).

Table 11. Soil Erosion Classes in the RM of Elton

Observed Erosion Class	Total area		% of RM
	ha	ac	
Non-eroded or minimal	45,649	112,799	79.01
Slightly	11,769	29,082	20.37
Moderately	117	290	0.20
Severely	3	8	0.01
Overblown or overwash	6	15	0.01
Organic	107	265	0.19
Water	94	233	0.16
Unclassified	30	75	0.05
Total	**57,776**	**142,767**	**100**

Soil erosion classes shown on Map 6 are based on the dominant soil for each polygon.

Map 6. Degree of Erosion Observed in the RM of Elton



4.8 Topography

Slope describes the steepness of the landscape surface. The degree and length of slope are important topographic factors affecting the potential for surface runoff and infiltration of precipitation.

Nine slope classes are used to denote the dominant, but not necessarily the most severe slopes within a mapping unit (Table 12).

Table 12. Slope Classes Used in Soil Map

Slope Class	Slope Description	% Slope
x	Level	0 - 0.5
b	Nearly level	>0.5 - 2.0
c	Very gently sloping	>2.0 - 5.0
d	Gently sloping	>5.0 - 9.0
e	Moderately sloping	>9.0 - 15
f	Strongly sloping	>15 - 30
g	Very strongly sloping	>30 - 45
h	Extremely sloping	>45 - 70
i	Steeply sloping	>70 - 100

Because part of the RM of Elton falls within the Brandon Lakes Plain land area, land slopes in the area are level and nearly level (TWP 11 RNG 19W and 18W).

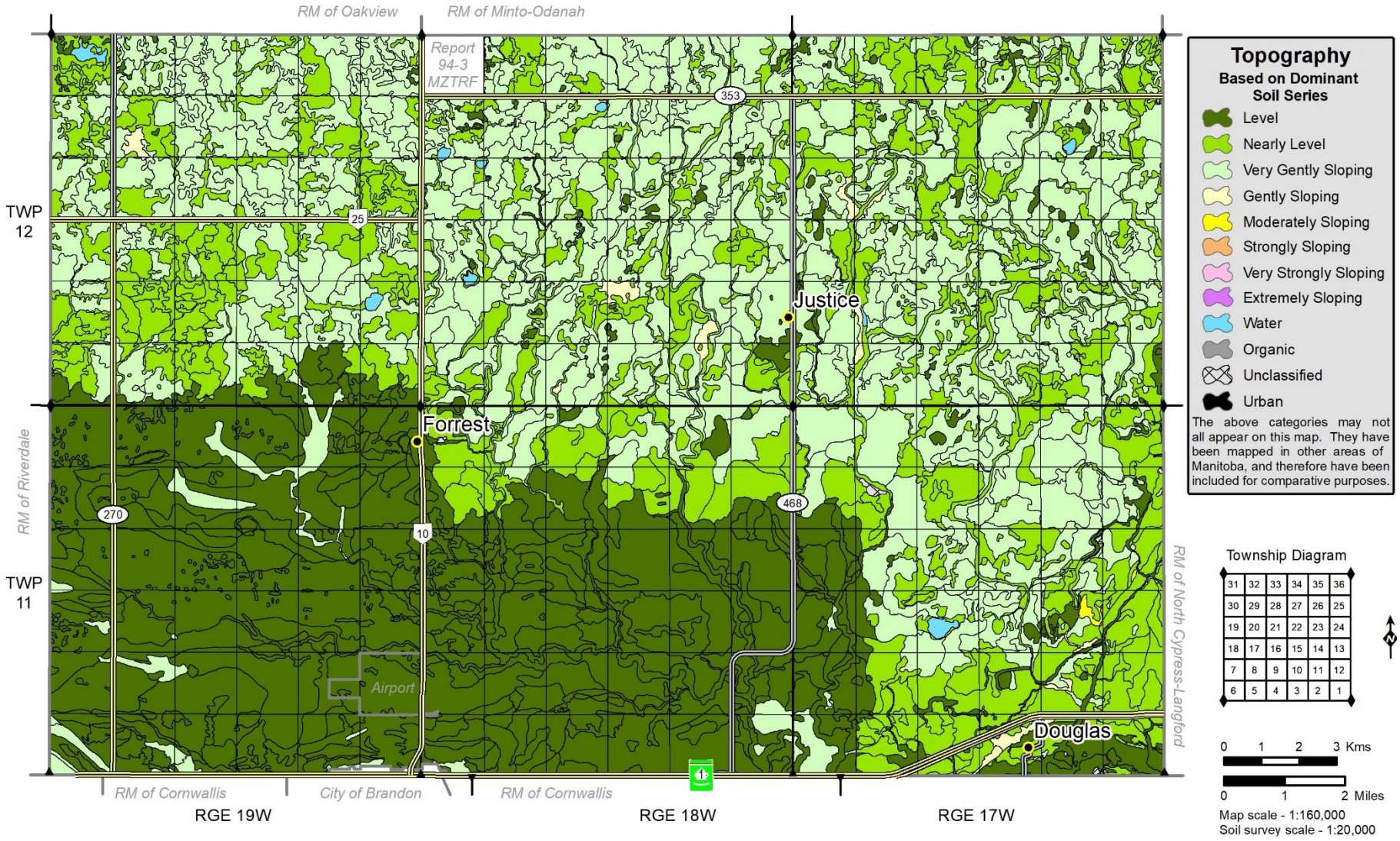
The majority of the land in the RM of Elton occurs mainly at three slope classes: very gently sloping (37%), level (34%), and nearly level (28%). Strongly to steeply sloping slopes are not common in the RM of Elton (Table 13). Changes in topography is marked by the transition from the Brandon Lakes Plain to the Newdale Till Plain (Figure 2 and Map 7).

Table 13. Topography observed in the RM of Elton

Topography (Slope Class)	Total area		% of RM
	ha	ac	
Level	19,904	49,183	34.45
Nearly level	16,237	40,123	28.10
Very gently sloping	21,130	52,214	36.57
Gently sloping	352	871	0.61
Moderately sloping	28	68	0.05
Water	94	233	0.16
Unclassified	30	75	0.05
Total	**57,776**	**142,767**	**100**

Topography classes shown on Map 7 are based on the dominant soil for each polygon.

Map 7. Topography of the RM of Elton



4.9 Stoniness

Soils with stones can hinder tillage, planting and harvesting operations. The degree of stoniness is described by five classes. Class 1 stoniness is not considered a limitation for soil capability, since there is little or no hindrance to cultivation and clearing is generally not required. Although stone clearing can be a mechanized procedure, it presents a management cost that does not occur in non-stony soils.

As aforementioned, stones are 25 to 60 cm in diameter, or if flat, 38 to 60 cm long. The classes of stoniness are defined as follows:

Stones 0 or x. (Non-stony) - land having less than 0.01% of surface occupied by stones.

Stones 1. (Slightly stony) - land having 0.01 to 0.1% of surface occupied by stones. Stones are 15 to 30 cm in diameter, 10 to 30 m apart. The stones offer only slight to no hindrance to cultivation.

Stones 2. (Moderately stony) - land having 0.1 to three per cent of surface occupied by stones. Stones are 15 to 30 cm in diameter, two to 10 m apart. Stones cause some interference with cultivation.

Stones 3. (Very stony) - Land having three to 15% of surface occupied by stones. Stones are 15 to 30 cm in diameter, one to two m apart. There are sufficient stones to constitute a serious hindrance to cultivation.

Stones 4. (Exceedingly stony) - Land having 15 to 50% of surface occupied by stones. Stones are 15 to 30 cm in diameter, 0.7 to 1.5 m apart. There are sufficient stones to prevent cultivation until considerable clearing has been done.

Stones 5. (Excessively stony) - Land having more than 50% of surface occupied by stones. Stones are 15 to 30 cm in diameter, less than 0.7 m apart. The land is too stony to permit cultivation until considerable clearing has occurred.

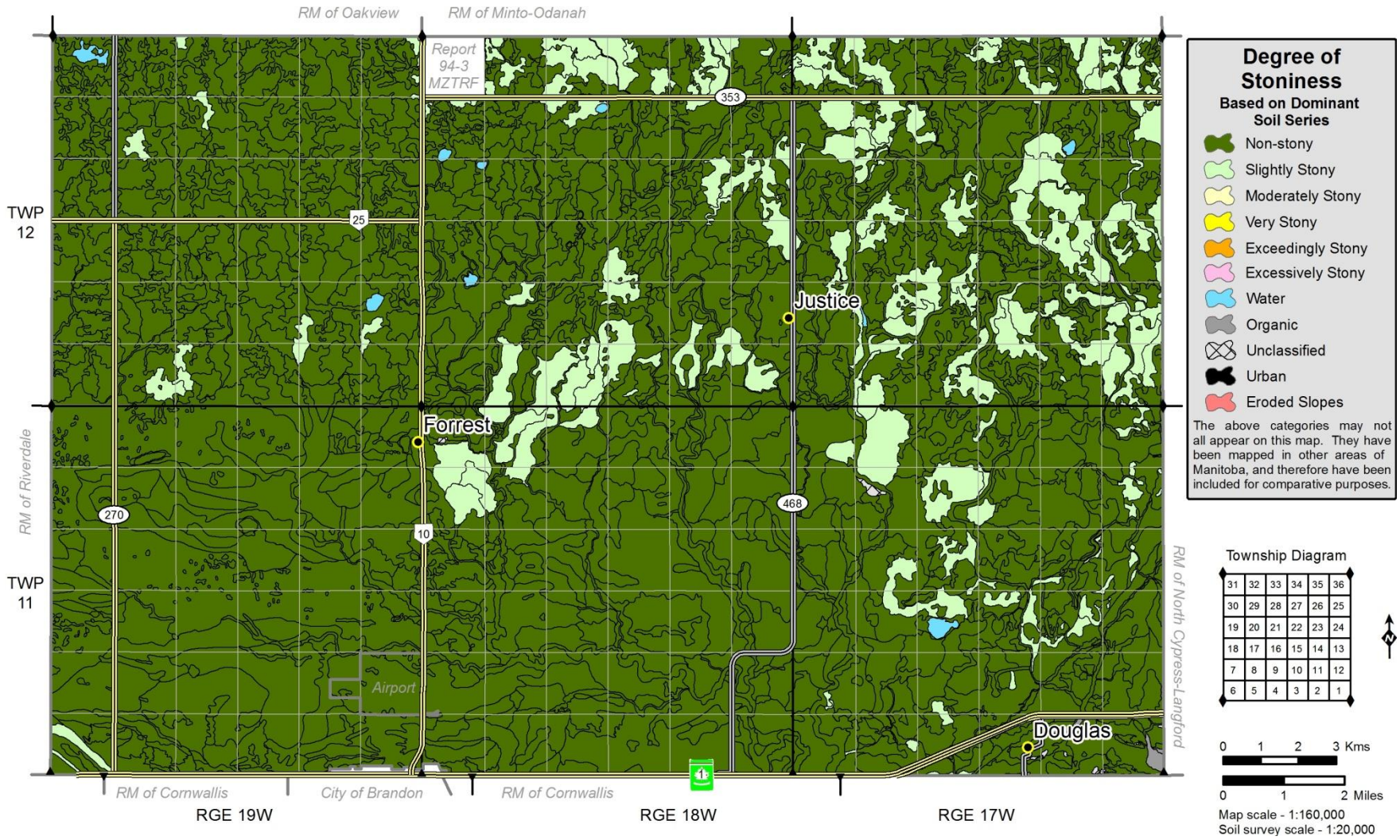
Stones in the RM of Elton are minimal. Non-stony and slightly stony soils account for 89 and 10% of the RM area, respectively (Table 14). The areas where the land is slightly stony are concentrated where the RM falls in the end moraine of the Newdale Till Plain (Figure 2 and Map 8).

Table 14. Stoniness Classes in the RM of Elton

Degree of Stoniness	Total area		% of RM
	ha	ac	
Non-stony	51,663	127,661	89.42
Slightly stony	5,878	14,525	10.17
Organic	107	265	0.19
Water	94	233	0.16
Eroded Slopes	3	8	0.01
Unclassified	30	75	0.05
Total	**57,776**	**142,767**	**100**

The degree of stoniness shown on Map 8 is based on the dominant condition for each polygon.

Map 8. Degree of Stoniness in the RM of Elton



4.10 Soil Chemical Properties

4.10.1 Salinity

Saline soils have a high concentration of soluble salts. The salts include sodium sulphate, magnesium sulphate, calcium sulphate, sodium chloride, magnesium chloride and calcium chloride.

The primary effect of salts in soils is the deprivation of water to plants. If the soil solution becomes too high in salts, the plants slowly starve, though the supply of water and dissolved nutrients in the soil may be sufficient.

In saline soils, crops usually grow poorly or not at all. At certain times of the year, the salts may precipitate out on the surface of the soil, leaving a white crust. Generally, plants which are affected by soil salinity have a bluish-green appearance. Common field weeds such as Russian thistle, kochia, wild barley, and foxtail often occur in areas of high salt concentration. In uncultivated areas, plants such as samphire, desert salt grass and greasewood are frequently dominant species (Henry et al, 1987).

Soil salinity is difficult to manage, because it is influenced by soil moisture conditions. In wet years, there is sufficient leaching and dissolving of salts so that salts are not visible on the surface and some crop growth may be possible. In dry years, increased evaporation dries out the soil and draws salts up to the soil surface, producing a white crust.

Field instrumentation, using a non-contacting terrain conductivity meter (EM-38 or a Dual EM), can determine if soluble salts are present.

Identification of salt affected areas and the selection of a salt tolerant crop are the most important management practices available to farmers.

A saline soil is defined as a soil with an electrical conductivity (EC) of the saturation extract greater than four milli-Siemens/cm (mS/cm), the exchangeable sodium percentage is less than 15, and the pH is usually less than 8.5.

Approximate limits of salinity classes are:

Class	EC mS/cm
Non-saline (x)	0 to 4
Weakly saline (s)	> 4 to 8
Moderately saline (t)	> 8 to 16
Strongly saline (u)	> 16

Note: mS/cm is equivalent to dS/m

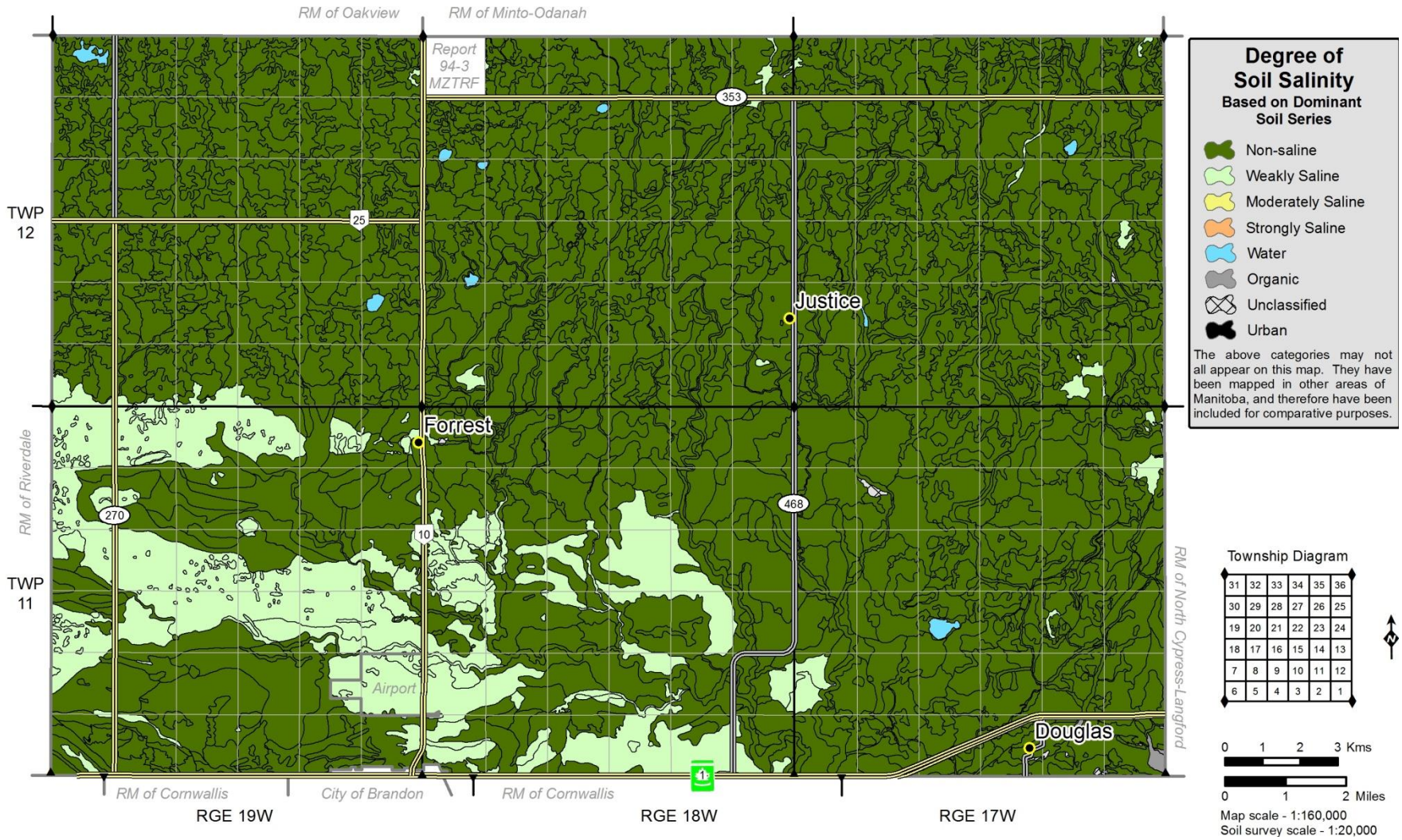
The soils in the RM of Elton fall mainly in the non-saline (87%) and weakly saline (13%) classes (Table 15). The weakly saline soils are concentrated in the southeastern portion in the RM of Elton; TWP 11, RNG 19W and 18W (Map 9).

Table 15. Soil Salinity Classes in the RM of Elton

Salinity Class	Total area		% of RM
	ha	ac	
Non-saline	50,163	123,955	86.82
Weakly saline	7,381	18,239	12.78
Organic	107	265	0.19
Water	94	233	0.16
Unclassified	30	75	0.05
Total	**57,776**	**142,767**	**100**

Map 9 are based on the dominant soil for each polygon.

Map 9. Degree of Salinity in the RM of Elton



4.10.2 Soil Organic Carbon, pH and $CaCO_3$

Selected soil chemical properties are summarized, based on 279 soil organic carbon (SOC), 191 soil pH and 109 soil calcium carbonate determinations (Table 16). Soil organic carbon SOC in the A horizon is affected by several factors. One of these factors is soil texture. For example, the fine textured Janick soil series averaged 39.25 g/kg of SOC, where the coarse textured Fairland soil averaged 34.95 g/kg.

Soil pH in A horizon in the RM of Elton ranges from 6.27 to 8.10 (Table 16). Large variations are due to different chemical processes occurring in the A horizon. All carbonate is generally leached out from A horizon in a well-drained Orthic Black Chernozems (Clementi, Janick and Newdale). Imperfectly drained Gleyed Black Chernozemic soils, regardless of soil texture (Charman and Prodan), also show less carbonate present in the A horizon.

Table 16. Soil Chemical Properties in the A horizon from Soils in the RM of Elton

Soil name	Soil code	Organic C (g/kg)		Soil pH		Ca carbonate (g/kg)	
		#	Avg	#	Avg	#	Avg
Angusville	ANL	2	25.60	2	7.24	--	--
Bankton	BAO	3	38.87	2	7.61	--	--
Barwood	BWO	10	46.91	6	7.18	4	100.73
Basker	BKR	1	47.50	1	8.00	--	--
Beresford	BSF	26	44.73	17	7.56	10	21.26
Bermont	BMN	13	41.75	7	7.34	7	93.20
Chambers	CBS	17	43.03	10	7.41	3	87.10
Charman	CXV	7	45.66	4	7.72	2	0.00
Clementi	CLN	23	46.60	17	7.04	1	0.00
Cobfield	CBF	10	46.03	8	7.32	1	0.00
Cordova	CVA	15	43.02	13	7.37	2	37.30
Drokan	DRO	3	42.83	2	8.06	--	--
Everton	EVO	4	40.18	4	7.47	--	--
Fairland	FND	2	34.95	1	6.98	1	0.00
Fenton	FET	3	48.63	4	8.10	5	52.76
Forrest	FRT	13	42.68	10	7.65	3	13.33
Harding	HRG	6	43.28	3	7.17	--	--
Hilton	HIT	4	43.60	3	7.22	--	--
Janick	JIK	2	39.25	1	8.02	1	0.00
Jaymar	JAY	1	34.60	1	7.03	--	--
Justice	JUC	3	42.50	3	7.55	--	--
Kleysen	KYS	3	41.30	2	7.49	1	38.30
Levine	LEI	1	53.00	1	7.87	--	--
Lowton	LWN	1	45.20	1	7.23	1	186.70
Newdale	NDL	19	46.86	11	7.15	7	7.19
Prodan	PDA	4	47.88	4	7.49	3	9.63
Ramada	RAM	4	48.40	3	6.73	3	0.00
Rufford	RUF	35	43.85	19	7.33	18	108.88
Sigmund	SGO	7	33.06	6	6.27	5	80.74
Tadpole	TDP	3	44.60	3	7.83	--	--
Taggart	TGR	2	46.05	1	7.61	1	54.20
Traverse	TAV	1	39.60	1	7.05	--	--
Varcoe	VRC	26	44.73	16	7.63	14	83.71
Vodroff	VFF	3	49.47	3	7.62	2	42.25
Wellwood	WWD	2	42.75	1	7.06	1	0.00

Part 5 Soil Suitability for Selected Engineering and Recreational Uses

5.1 Introduction

This section provides information that can be used by engineers and land use planners. It is intended to supplement the information on the soil map with additional data on engineering properties of soils.

5.2 Soil Suitability for Selected Engineering Uses

The criteria used to evaluate soil suitability for selected engineering and related recreational uses are adopted from guides outlined by Coen et al (1977), and from guidelines developed by the Soil Conservation Service, United States Department of Agriculture (USDA, 1971), and the Canada Soil Survey Committee (CSSC, 1973).

The evaluation of soil suitability for engineering and recreation uses is based on both internal and external soil characteristics. Four soil suitability classes are used to evaluate both mineral and organic soils. These ratings express relative degrees of suitability or limitation for potential uses of natural or essentially undisturbed soils. The long-term effects of the potential use on the behaviour of the soil are considered in the rating.

The four suitability class ratings are defined as follows:

(G) Good – Soils in their present state have few or minor limitations that would affect the proposed use. The limitations can easily be overcome with minimal cost.

(F) Fair – Soils in their present state have one or more moderate limitations that would affect the proposed use. These moderate limitations can be overcome with special construction, design, planning or maintenance.

(P) Poor – Soils in their present state have one or more severe limitations that can severely affect the proposed use. Removal of these limitations would be difficult or costly.

(V) Very Poor – Soils have one or more unfavourable features for the proposed use and the limitation is very difficult and expensive to overcome, or the soil would require such extreme alteration that the proposed use is economically impractical.

The basic soil properties that alone or in combination with others affect soil suitability for selected engineering and recreation uses are provided in Table 17. These subclass designations serve to identify the kind of limitation or hazard for a particular use.

In assessing soil suitability for various engineering uses, the degree of suitability is determined by the most restrictive or severe rating assigned to any one of the listed soil properties. For example, if the suitability is Good for all but one soil property, and it is estimated to be Very Poor, then the overall rating of the soil for that selected use is Very Poor. Suitability of individual soil properties, if estimated to be Fair or Poor, can be accumulative in their effect for a particular use. Judgement is required to determine whether the severity of the combined effects of several soil properties on suitability for a particular use will result in downgrading an evaluation. This is left to the discretion of the interpreter. It is incorrect to assume that each of the major soil properties influencing a particular use has an equal effect. Class limits established for rating the suitability of individual soil properties take this into account. Therefore, for a selected use, therefore, only those soil properties that most severely limit that use, are specified.

The suitability ratings of soils for 10

selected engineering uses are shown in Table A8 of Appendix 1. When using these interpretations, consideration must be given to the following assumptions:

1. Soil ratings do not include site factors, such as proximity to towns and highways, water supply or aesthetic values.

2. Soil ratings are based on natural, undisturbed conditions.

3. Soil suitability ratings are usually given for the entire soil depth, but for some uses, they may be based on the limitations of an individual soil horizon or layer, because of its overriding importance. Ratings rarely apply to soil depths greater than one to two metres, but in some soils, reasonable estimates can be given for soil material at greater depths.

4. Poor and very poor soil ratings do not imply that a site cannot be changed to remove, correct or modify the limitations.

5. Interpretations of map units do not eliminate the need for on-site evaluation by qualified professionals. Due to the variable nature of soils and the scale of mapping, small, unmappable inclusions of soils with different properties may be present in an area where a development is planned.

Guides for evaluating soil suitability for engineering uses are presented in Tables of A9 to A18 of Appendix 1.

Table 17. Codes Used to Identify Subclass Limitations in Evaluating Soil Suitability for Selected Engineering Uses in Table A8 of Appendix 1

Code	Description
a	sub-grade properties
b	thickness of topsoil
c	coarse fragments on surface
d	depth to bedrock
e	erosion or erodibility
f	susceptibility to frost hazard
g	contamination hazard of groundwater
h	depth to seasonal water table
i	flooding or inundation
j	thickness of slowly permeable material
k	permeability or hydraulic conductivity
l	shrink-swell properties
m	moisture limitations or deficit
n	salinity or sulphate hazard
o	organic matter
p	stoniness
q	depth to sand or gravel
r	rockiness
s	surface texture
t	topographic slope class
u	moist consistence
w	wetness or soil drainage class
z	permafrost

5.3 Soil Suitability for Selected Recreational Uses

This section provides interpretations of the soil suitability for recreational development. All types of soil can be used for recreational activities of some kind.

Soils and their properties contribute to the determination of the type and location of recreational facilities. Wet soils are not suitable for campsites, roads, playgrounds or picnic areas. Soils that pond and dry out slowly after heavy rains present problems where intensive use is planned. It is difficult to maintain grass cover for playing fields and golf courses on droughty soils. The feasibility of many kinds of outdoor activities are determined by many basic soil properties, such as depth to bedrock, stoniness, topography or land pattern, and the ability of the soil to support vegetation of different kinds, as related to its natural fertility.

The suitability of the various soil series and phases for selected recreational uses is shown in Table A8 of Appendix 1. The four classes, Good, Fair, Poor and Very Poor are defined in the section on Engineering Uses. Subclasses are the same as described in Table 17. Guides for evaluating soil suitability for recreational uses are presented in Tables A19 to A22 of Appendix 1.

Appendix 1

A: Definitions of the Agricultural Capability Classes

Class 1

Soils in this Class have no important limitations for crop use. The soils have level or gently sloping topography, as well as being deep, well to imperfectly drained, and have moderate water holding capacity. The soils are naturally well supplied with plant nutrients, easily maintained in good tilth and fertility. Soils are moderately high to high in productivity for a wide range of cereal and special crops.

Class 2

Soils in this Class have moderate limitations that reduce the choice of crops or require moderate conservation practices. The soils have good water holding capacity and are either naturally well supplied with plant nutrients or are highly responsive to the addition of fertilizer. They are moderate to high in productivity for a wide range of crops. The limitations are not severe and good soil management and cropping practices can be applied without serious difficulty.

Class 3

Soils in this Class have moderately severe limitations that restrict the range of crops or require special conservation practices. The limitations in Class 3 are more severe than those in Class 2, and conservation practices are more difficult to apply and maintain. The limitations affect the timing and ease of tillage, planting and harvesting, the choice of crops and maintenance of conservation practices. The limitations include one or more of the following: moderate climatic limitation, erosion, structure or permeability, low fertility, topography, overflow, wetness, low water-holding capacity or slowness in release of water to plants, stoniness and depth of soil to consolidated bedrock. Under good management, these soils are fair to moderately high in productivity for a wide range of field crops.

Class 4

Soils in this Class have severe limitations that restrict the choice of crops or require special conservation practices or both. These soils have such limitations that they are only suited for a few crops or the yield for a range of crops may be low, or the risk of crop failure is high. The limitations may seriously affect such farm practices as the timing and ease of tillage, planting and harvesting, and the application and maintenance of conservation practices. These soils are low to medium in productivity for a narrow range of crops, but may have higher productivity for a specially adapted crop. The limitations include the adverse effects of one or more of the following: climate, accumulative undesirable soil characteristics, low fertility, reduced storage capacity or release of soil moisture to plants, structure or permeability, salinity, erosion, topography, overflow, wetness, stoniness, and depth of soil to consolidated bedrock.

Class 5

Soils in this Class have very severe limitations that restrict their capability to producing perennial forage crops, and improvement practices are feasible. These soils have severe soil, climatic or other limitations, and are not capable of sustained production of annual field crops. However, they may be improved by the use of farm machinery for the production of native or tame perennial forage species. Feasible improvement practices include clearing of bush, cultivation, seeding, fertilization and water control. Some soils in Class 5 can be used for cultivated field crops, provided intensive management is used. Some of these soils are also adapted to special crops requiring soil conditions unlike those needed by the common crops.

Class 6

Soils in this Class are capable only of producing perennial forage crops, and improvement practices are not feasible. Class 6 soils have some natural sustained grazing capacity for farm animals, but have such serious soil, climatic or other limitations as to make impractical the application of improvement practices that can be carried out on Class 5 soils. Soils may be placed in this class because their physical nature prevents the use of farm machinery, or because the soils are not responsive to improvement practices, or because stock watering facilities are inadequate.

Class 7

Soils in this class have no capability for arable culture or permanent pasture, because of extremely severe limitations. Bodies of water too small to delineate on the map are included in this class. These soils may or may not have a high capability for forestry, wildlife and recreation.

B: Agricultural Capability Subclass Limitations

C – **Adverse climate:** This subclass denotes a significant adverse climate for crop production as compared to the median climate, which is defined as one with sufficiently high growing season temperatures to bring field crops to maturity, and with sufficient precipitation to permit crops to be grown each year on the same land without a serious risk of partial or total crop failures.

D – **Undesirable soil structure and/or low permeability:** This subclass is used for soils difficult to till, or which absorb water very slowly, or in which the depth of rooting zone is restricted by conditions other than a high water table or consolidated bedrock.

E – **Erosion:** Subclass E includes soils where damage from erosion is a limitation to agricultural use. Damage is assessed on the loss of productivity and on the difficulties in farming land with gullies.

F – **Low fertility:** This subclass is made up of soils having low fertility that either is correctable with careful management in the use of fertilizers and soil amendments, or is difficult to correct in a feasible way. The limitation may be due to lack of available plant nutrients, high acidity or alkalinity, low exchange capacity, high levels of carbonates or presence of toxic compounds.

I – **Inundation by streams or lakes:** This subclass includes soils subjected to inundation causing crop damage or restricting agricultural use.

L – **Coarse wood fragments:** In the rating of organic soils, woody inclusions in the form of trunks, stumps and branches (>10 cm diameter) in sufficient quantity to significantly hinder tillage, planting and harvesting operations.

M – **Moisture limitation:** This subclass consists of soils where crops are adversely affected by droughtiness due to inherent soil characteristics. They are usually soils with low water-holding capacity.

N – **Salinity:** Designates soils, which are adversely affected by the presence of soluble salts.

P – **Stoniness:** This subclass is comprised of soils sufficiently stony to significantly hinder tillage, planting, and harvesting operations. Stony soils are usually less productive than comparable non-stony soils.

R – **Consolidated bedrock:** This subclass includes soils where the presence of bedrock near the surface restricts their agricultural use. Consolidated bedrock at depths greater than one metre from the surface is not considered a limitation, except on irrigated lands where a greater depth of soil is desirable.

T – **Topography:** This subclass is made up of soils where topography is a limitation. Both the percentage of slope and the pattern or frequency of slopes in different directions are important factors in increasing the cost of farming over that of smooth land, in decreasing the uniformity of growth and maturity of crops, and in increasing the hazard of water erosion.

W – **Excess water:** Subclass W is made up of soils where excess water other than that brought about by inundation is a limitation to their use for agriculture. Excess water may result from inadequate soil drainage, a high water table, seepage or runoff from surrounding areas.

X – **Cumulative minor adverse characteristics:** This subclass is made up of soils having a moderate limitation caused by the cumulative effect of two or more adverse characteristics, which alone are not serious enough to affect the class rating.

Table A1. Dryland Agriculture Capability Guidelines for Manitoba*

	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7
Subclass Limitations	No significant limitations in use for crops.	Moderate limitations that restrict the range of crops or require moderate conservation practices.	Moderately severe limitation that restrict the range of crops or require special conservation practices.	Severe limitations that restrict the range of crops or require special conservation practices or both.	Very severe limitations that restrict soil capability to produce perennial forage crops, and improvement prac-tices are feasible.	Soils are capable only of producing perennial forage crops, and improvement practices are not feasible.	No capability for arable culture or permanent pasture.
Climate (C)	All Ecodistricts[1] within ARDA boundary not explicitly listed under 2C and 3C.	Ecodistricts: 664, 666, 668, 670, 671, 672, 674, 675, 676, 677, 714, 715, 716	Ecodistricts: 356, 357, 358, 359, 363, 366, 663, 665	None within ARDA boundary			
Consolidated Bedrock (R)				> 50 -100 cm	20 - 50 cm	< 20 cm	Surface bedrock Fragmental over bedrock
Moisture limitation[2] (M)		Stratified loams Moderate moisture holding capacity	Loamy sands Low moisture holding capacity	Sands Very low moisture holding capacity	Skeletal sands Very severe moisture deficiency	Stabilized sand dunes	Active sand dunes
Topography[3] (T)	a, b (0 - 2%)	c (> 2 - 5%)	d (> 5 - 9%)	e (> 9 - 15%)	f (> 15 - 30%)	g (> 30 - 45%) Eroded slope complex	h (> 45 - 70%) i (> 70 - 100%)
Structure and/or Permeability (D)	Granular clay	Massive clay or till soils[4] Slow permeability	Solonetzic intergrades Very slow permeability	Black Solonetz Extremely slow permeability			
Salinity[5] (N) **0 - 60 cm depth** **60 - 120 cm depth**	NONE < 2 dS/m < 4 dS/m	WEAK 2 - 4 dS/m 4 - 8 dS/m	MODERATE (s) > 4 - 8 dS/m > 8 - 16 dS/m	STRONG (t) > 8 - 16 dS/m > 16 - 24 dS/m	VERY STRONG (u) [6] > 16 - 24 dS/m > 24 dS/m		Salt Flats
Inundation[7] (I)	No overflow during growing season	Occasional overflow (1 in 10 years)	Frequent overflow (1 in 5 years) Some crop damage	Frequent overflow (1 in 5 years) Severe crop damage	Very frequent (1 in 3 years) Grazing > 10 weeks	Very frequent Grazing 5 - 10 weeks	Land is inundated for most of the season
Excess Water (W)	Well and Imperfectly drained		Loamy to fine textured Gleysols with improved drainage	Coarse textured Gleysols with improved drainage	Poorly drained, no improvements	Very Poorly drained	Open water, marsh
Stoniness (P)	Nonstony (0) and Slightly Stony (1)	Moderately Stony (2)	Very Stony (3) [8]	Exceedingly Stony (4) [9]		Excessively Stony (5)	Cobbly Beach Fragmental
Erosion[10] (E)		Moderate erosion (2)	Severe wind or water erosion (3) lowers the basic rating by one class to a maximum rating of Class 6 [11].				
Cumulative minor adverse Characteristics[12] (X)							

* Based on the Canada Land Inventory Soil Capability Classification for Agriculture (1965), with modifications made for soil application at larger mapping scales.

1 Smith, R.E., H. Veldhuis, G.F. Mills, R.G. Eilers, W.R. Fraser, M. Santry, 1996. Terrestrial Ecoregions and Ecodistricts of Manitoba, An Ecological Stratification of Manitoba's Natural Landscapes. Agriculture and Agri-Food Canada, Research Branch, Brandon Research Centre, Manitoba Land Resource Unit, Winnipeg, MB. Report and Provincial Map at scale of 1:1.5m.

2 With the exception of Class 2, ratings as indicated are based on the assumption of a single parent material, using the most readily drained representative of each textural class. Prevailing climatic conditions within the Ecodistrict, soil drainage and stratification will affect the moisture limitation accordingly.

3 Topographic classes are based on the most limiting slope covering a significant portion of an area of complex, variable slopes. Map units with long, unidirectional slopes may be considered equivalent or one class worse due to an increased erosion hazard.

4 Extremely calcareous, loamy till soils with a high bulk density (>1.7 g/cm^3) are rated 3D.

5 Soil Salinity is reported in DeciSiemens/metre (dS/m). Soil will be classed according the most saline depth. For example, if a soil is non-saline from zero to 60 cm, but moderately saline from 60 to 120 cm, the soil will be classed as moderately saline (3N).

6 Strongly saline (u) soils are rated 5N, with the exception of poorly and very poorly drained soils, which are rated 6NW.

7 Inundation may be listed as a secondary subclass for some fluvial soils. In this case, inundation is not class determining, but may become a limitation if the soil is otherwise improved.

8 Extremely calcareous, loamy till soils with a high bulk density (>1.7 g/cm^3) and stony 3 are rated 4DP (4RP if depth to bedrock is 50 - 100 cm).

9 Stony 4 soils will be rated 4P, unless their primary physical composition is sandy skeletal or their parent material is till. In either or both of these cases, the soil will be rated 5P.

10 If erosion is moderate, a subclass of E is assigned as a secondary limitation, but the basic rating is not lowered. If erosion is severe, the basic soil rating is downgraded by one class, and E becomes the primary limitation. For example, if a soil has a basic rating of 4T, the presence of moderate erosion will result in a rating of 4TE. If erosion is severe, the rating will be lowered to 5ET. Erosion will be the sole limitation, only if the basic rating has a subclass of X. For example, a soil with a rating of 3X will be assigned a rating of 3E if moderate erosion is present.

11 The rating is not lowered from Class 6 based on erosion. A rating of 6TE indicates a soil with g topography and either moderate or severe erosion.

12 Use only for soils with no other limitation except climate. The subclass represents soils with a moderate limitation caused by the cumulative effect of two or more adverse characteristics that are singly not serious enough to affect the rating. Because the limitation is moderate, soils may only be downgraded by one class from their initial climate limitation. Therefore, a soil with a climate limitation of 2C and two or more minor adverse characteristics will be rated as 3X. This symbol is always used alone.

Table A2. Ag Capability and Irrigation Suitability of Soils in the RM of Elton

Soil name (Soil code)	Soil phase	Agricultural capability	Irrigation suitability			Total area		% of RM
			Class	General rating	Rating for potato production	ha	ac	
Eroded Slope Complex	xexx	6E	4m Ct2	Poor	5	3.2	7.8	0.01
Marsh	xxxx	7W	4wx Di	Poor	5	346.0	854.9	0.60
Unclassified land	xxxx	-	-	-	-	30.4	75	0.05
Water	xxxx	-	-	-	-	94.3	233	0.16
Ashmore (AHO)	1c1x	4M	2m Bt2	Good	4	5.3	13	0.01
	xxxx	4M	2m A	Good	3	25.1	62	0.04
Arizona (AIZ)	1cxx	5ME	3m Bt2	Fair	3	11.2	27.6	0.02
Angusville (ANL)	1cxx	2WT	3kw Bt2	Fair	4	10.4	25.7	0.02
	xbxx	2W	3kw A	Fair	4	27.2	67.1	0.05
	xc1x	2WT	3kw Bt2	Fair	4	17.8	44	0.03
	xcxx	2WT	3kw Bt2	Fair	4	118.8	293.7	0.21
Assiniboine (ASB)	xbxx	3I	3kw Bi	Fair	5	1.0	2.4	0.00
Bankton (BAO)	xbxx	2D	4kx A	Poor	5	5.0	12.4	0.01
	xcxx	2TD	4kx Bt2	Poor	5	16.2	40	0.03
	xxxx	2D	4kx A	Poor	5	68.1	168.4	0.12
Basker (BKR)	xbxx	5IW	4w Ci	Poor	5	42.3	104.5	0.07
	xxxx	5IW	4w Ci	Poor	5	284.0	701.8	0.49
Bermont (BMN)	1b1x	2X	2kx A	Good	4	47.3	116.9	0.08
	1bxx	2X	2kx A	Good	4	10.5	25.9	0.02
	1c1x	2T	2kx Bt2	Good	4	892.9	2,206.4	1.55
	1cxx	2T	2kx Bt2	Good	4	380.1	939.3	0.66
	1d1x	3T	2kx Ct2	Fair	4	37.6	92.9	0.07
	1dxx	3T	2kx Ct2	Fair	4	20.6	50.9	0.04
	2d1x	3TE	2kx Ct2	Fair	4	0.7	1.8	0.00
	2dxx	3T	2kx Ct2	Fair	4	9.3	23.1	0.02
	xb1x	2X	2kx A	Good	4	84.7	209.3	0.15
	xbxx	2X	2kx A	Good	4	116.2	287.1	0.20
	xc1x	2T	2kx Bt2	Good	4	199.2	492.3	0.34
	xcxx	2T	2kx Bt2	Good	4	586.5	1,449.3	1.02
Beresford (BSF)	1b1x	2W	3sw A	Fair	4	27.9	68.9	0.05
	1bxx	2W	3sw A	Fair	3	17.2	42.4	0.03
	1c1x	2WT	3w Bt2	Fair	4	10.1	25	0.02
	1cxx	2WT	3w Bt2	Fair	3	30.4	75.2	0.05
	1xxs	3N	3sw A	Fair	4	1,962.4	4,849.1	3.40
	1xxx	2W	3w A	Fair	3	525.2	1,297.9	0.91
	xb1s	3N	3sw A	Fair	4	5.4	13.3	0.01
	xb1x	2W	3w A	Fair	4	143.0	353.5	0.25
	xbxs	3N	3sw A	Fair	4	80.0	197.7	0.14
	xbxx	2W	3w A	Fair	3	2,572.1	6,355.9	4.45
	xc1s	3N	3sw Bt2	Fair	4	5.8	14.3	0.01
	xc1x	2WT	3w Bt2	Fair	4	71.0	175.4	0.12
	xcxx	2WT	3w Bt2	Fair	3	763.2	1,886	1.32

Table A2. Ag Capability and Irrigation Suitability of Soils in the RM of Elton (cont'd)

Soil name (Soil code)	Soil phase	Agricultural capability	Irrigation suitability			Total area		% of RM
			Class	General rating	Rating for potato production	ha	ac	
Beresford (BSF)	xdxx	3T	3w Ct2	Fair	4	0.9	2.2	0.00
	xxxs	3N	3sw A	Fair	4	584.0	1,443.1	1.01
	xxxx	2W	3w A	Fair	3	2,322.3	5,738.5	4.02
Barwood (BWO)	1cxx	2WT	3w A	Fair	4	9.5	23.6	0.02
	xbxx	2W	3w A	Fair	4	359.2	887.7	0.62
	xb1x	2W	3w A	Fair	4	66.5	164.4	0.12
	xc1x	2WT	3w Bt2	Fair	4	7.1	17.6	0.01
	xcxx	2WT	3w Bt2	Fair	4	207.2	512	0.36
	xxxx	2W	3w A	Fair	4	14.1	34.9	0.02
Carvey (CAV)	xbxx	5W	4w A	Poor	5	32.4	80.1	0.06
	xxxx	5W	4w A	Poor	5	158.7	392.3	0.27
Carvey, peaty (CAVp)	xxxx	6W	4w A	Poor	5	94.3	233.1	0.16
Cobfield (CBF)	1cxx	2WT	3w Bt2	Fair	4	2.8	6.9	0.00
	xb1x	2W	3w A	Fair	4	118.5	292.9	0.21
	xbxs	3N	3sw A	Fair	4	2.3	5.6	0.00
	xbxx	2W	3w A	Fair	4	475.3	1,174.6	0.82
	xc1x	2WT	3w Bt2	Fair	4	80.3	198.4	0.14
	xcxx	2WT	3w Bt2	Fair	4	248.3	613.5	0.43
	xxxx	2W	3w A	Fair	4	270.9	669.3	0.47
Chambers (CBS)	1b1x	2X	2kx A	Good	4	44.0	108.8	0.08
	1bxx	2X	2kx A	Good	4	8.3	20.6	0.01
	1c1x	2T	2kx Bt2	Good	4	78.7	194.4	0.14
	1cxx	2T	2kx Bt2	Good	4	292.6	723	0.51
	1dxx	3T	2kx Ct2	Fair	4	20.3	50.1	0.04
	1xxx	2X	2kx A	Good	4	238.1	588.3	0.41
	2cxx	2TE	2kx Bt2	Good	4	9.6	23.7	0.02
	xb1x	2X	2kx A	Good	4	75.8	187.4	0.13
	xbxx	2X	2kx A	Good	4	630.9	1,558.9	1.09
	xc1x	2T	2kx Bt2	Good	4	129.7	320.5	0.22
	xcxx	2T	2kx Bt2	Good	3	907.3	2,241.9	1.57
	xdxx	3T	2kx Ct2	Fair	4	3.6	8.9	0.01
	xxxx	2X	2kx A	Good	4	171.6	424.1	0.30
Cactus (CCS)	2cxx	4M	2m Ct2	Fair	2	4.3	10.6	0.01
	2xxx	4M	2m A	Good	2	26.5	65.6	0.05
Crookdale (CKD)	1xxx	2W	3w A	Fair	3	17.6	43.6	0.03
	xbxx	2W	3w A	Fair	3	65.9	162.9	0.11
	xxxx	2W	3w A	Fair	3	179.0	442.3	0.31
Clementi (CLN)	1b1x	2X	2kx A	Good	4	83.5	206.4	0.14
	1c1x	2T	2kx Bt2	Good	4	214.3	529.5	0.37
	1cxx	2T	2kx Bt2	Good	4	536.9	1,326.6	0.93
	1xxx	2X	2kx A	Good	4	348.9	862.2	0.60
	2c1x	2TE	2kx Bt2	Good	4	2.3	5.7	0.00

Table A2. Ag Capability and Irrigation Suitability of Soils in the RM of Elton (cont'd)

Soil name (Soil code)	Soil phase	Agricultural capability	Irrigation suitability			Total area		‰ of RM
			Class	General rating	Rating for potato production	ha	ac	
Clementi (CLN)	xb1x	1	2kx A	Good	4	154.5	381.7	0.27
	xbxx	1	2kx A	Good	4	1,029.9	2,545	1.78
	xc1x	2T	2kx Bt2	Good	4	157.5	389.2	0.27
	xcxx	2T	2kx Bt2	Good	4	1,381.6	3,413.9	2.39
	xd1x	3T	2kx Ct2	Fair	4	22.2	54.8	0.04
	xxxx	1	2kx A	Good	4	463.8	1,146.1	0.80
Cordova (CVA)	1c1x	2T	2kx Bt2	Good	4	119.4	294.9	0.21
	1cxx	2T	2kx Bt2	Good	4	285.2	704.6	0.49
	1d1x	3T	2kx Ct2	Fair	4	6.5	16.1	0.01
	xbxx	2X	2kx A	Good	4	104.3	257.7	0.18
	xc1x	2T	2kx Bt2	Good	4	113.1	279.4	0.20
	xcxx	2T	2kx Bt2	Good	4	314.0	775.8	0.54
	xxxx	2X	2kx A	Good	4	8.7	21.6	0.02
Carroll (CXF)	1cxx	2T	2k Bt2	Good	2	11.8	29.1	0.02
	xbxx	2X	2k A	Good	2	94.2	232.8	0.16
Capell (CXT)	xb1x	2M	3w A	Fair	4	38.6	95.3	0.07
	xbxx	2M	3w A	Fair	3	55.3	136.6	0.10
	xcxx	2MT	3w Bt2	Fair	3	5.9	14.5	0.01
	xxxs	3N	3sw A	Fair	4	23.6	58.4	0.04
	xxxx	2M	3w A	Fair	3	126.5	312.5	0.22
Charman (CXV)	xbxs	3N	3sw A	Fair	4	48.0	118.6	0.08
	xbxx	2W	3w A	Fair	3	79.5	196.4	0.14
	xcxx	2WT	3w Bt2	Fair	3	12.2	30.2	0.02
	xxxx	2W	3w A	Fair	3	262.6	648.8	0.45
Croyon (CYN)	1cxx	3M	2gm Bt2	Good	3	19.2	47.5	0.03
	xbxx	3M	2gm A	Good	3	71.9	177.6	0.12
	xc1x	3M	2gm Bt2	Good	4	1.1	2.6	0.00
	xcxx	3M	2gm Bt2	Good	3	26.8	66.2	0.05
Dogand (DGA)	xbxx	3M	2m A	Good	4	5.7	14	0.01
	xcxx	3M	2m Ct2	Fair	4	11.2	27.6	0.02
Dorset (DOT)	1bxx	5M	4m A	Poor	5	0.8	2	0.00
	xbxx	5M	4m A	Poor	5	68.1	168.4	0.12
	xcxx	5M	4m Bt2	Poor	5	18.2	45	0.03
Durnan (DRN)	1cxx	2T	1 Bt2	Good	1	5.7	14	0.01
	xxxx	2X	1 A	Excellent	1	81.5	201.4	0.14
Drokan (DRO)	xbxs	5W	4w A	Poor	5	9.7	24	0.02
	xbxx	5W	4w A	Poor	5	1,036.8	2,561.9	1.79
	xcxx	5W	4w Bt2	Poor	5	109.0	269.4	0.19
	xxxs	5W	4w A	Poor	5	15.0	37.1	0.03
	xxxx	5W	4w A	Poor	5	136.3	336.8	0.24
Druxman (DXM)	xbxx	2M	3w A	Fair	3	9.4	23.3	0.02
Everton (EVO)	1xxx	1	4k A	Poor	5	18.0	44.5	0.03

Table A2. Ag Capability and Irrigation Suitability of Soils in the RM of Elton (cont'd)

Soil name (Soil code)	Soil phase	Agricultural capability	Irrigation suitability			Total area		% of RM
			Class	General rating	Rating for potato production	ha	ac	
Everton (EVO)	xbxx	1	4k A	Poor	5	355.5	878.5	0.62
	xcxx	2T	4k Bt2	Poor	5	124.9	308.7	0.22
	xxxx	1	4k A	Poor	5	239.3	591.4	0.41
Fenton (FET)	xbxs	5W	4kw A	Poor	5	21.9	54	0.04
	xbxx	5W	4kw A	Poor	5	143.1	353.6	0.25
	xcxx	5W	4kw A	Poor	5	9.5	23.4	0.02
	xxxs	5W	4kw A	Poor	5	10.4	25.8	0.02
	xxxx	5W	4kw A	Poor	5	17.6	43.4	0.03
Fairland (FND)	1cxx	2T	1 Bt2	Good	1	204.3	504.9	0.35
	1dxx	3T	1 Ct2	Fair	4	24.3	60	0.04
	1xxx	1	1 A	Excellent	1	34.1	84.2	0.06
	xbxx	1	1 A	Excellent	1	93.3	230.6	0.16
	xcxx	2T	1 Bt2	Good	1	2.8	7	0.00
	xxxx	1	1 A	Excellent	1	69.0	170.5	0.12
Forrest (FRT)	xbxx	2W	4k A	Poor	5	536.4	1,325.4	0.93
	xcxx	2WT	4k Bt2	Poor	5	112.8	278.8	0.20
	xxxs	3N	4k A	Poor	5	163.3	403.5	0.28
	xxxx	2W	4k A	Poor	5	225.5	557.2	0.39
Glenboro (GBO)	1bxx	2M	1 A	Excellent	1	35.8	88.4	0.06
	1cxx	2MT	1 Bt2	Good	1	15.2	37.4	0.03
	xcxx	2MT	1 Bt2	Good	1	5.9	14.5	0.01
	xbxx	2M	1 A	Excellent	1	114.6	283.2	0.20
	xcxx	2MT	1 Bt2	Good	1	17.6	43.6	0.03
	xxxx	2M	1 A	Excellent	1	7.7	19	0.01
Gendzel (GDZ)	1cxx	4M	3mw Bt2	Fair	3	1.9	4.7	0.00
Gregg (GRG)	xbxx	2W	3kw A	Fair	3	12.2	30.2	0.02
	xxxx	2W	3kw A	Fair	3	8.5	21.1	0.01
Grover (GRO)	xxxx	2W	2w A	Good	3	178.5	441	0.31
Gateside (GTD)	xxxs	3N	3s A	Fair	4	10.7	26.4	0.02
	xxxx	2M	2w A	Good	3	552.9	1,366.2	0.96
Grayson (GYS)	xxxx	5W	4w A	Poor	5	15.4	38.1	0.03
Hilton (HIT)	1c1x	2T	2kx Bt2	Good	4	151.6	374.7	0.26
	1cxx	2T	2kx Bt2	Good	4	241.3	596.1	0.42
	1xxx	2X	2kx A	Good	4	26.9	66.5	0.05
	xbxx	2X	2kx A	Good	4	35.7	88.2	0.06
	xc1x	2T	2kx Bt2	Good	4	108.3	267.5	0.19
	xcxx	2T	2kx Bt2	Good	4	101.8	251.6	0.18
	xxxx	2X	2kx A	Good	4	6.5	15.9	0.01
Hickson (HKS)	xbxx	5W	4w A	Poor	5	42.9	106.1	0.07
	xxxx	5W	4w A	Poor	5	0.3	0.6	0.00
Harding (HRG)	xbxx	2W	4kx A	Poor	5	174.0	430.1	0.30
	xcxx	2WT	4kx Bt2	Poor	5	62.4	154.1	0.11

Table A2. Ag Capability and Irrigation Suitability of Soils in the RM of Elton (cont'd)

Soil name (Soil code)	Soil phase	Agricultural capability	Irrigation suitability			Total area		% of RM
			Class	General rating	Rating for potato production	ha	ac	
Harding (HRG)	xxxs	3N	4kx A	Poor	5	8.0	19.8	0.01
	xxxx	2W	4kx A	Poor	5	92.3	228	0.16
Jaymar (JAY)	xb1x	3M	2m A	Good	4	19.8	48.9	0.03
	xbxx	3M	2m A	Good	4	56.2	138.9	0.10
	xc1x	3M	2m Bt2	Good	4	27.0	66.6	0.05
	xcxx	3M	2m Bt2	Good	4	69.3	171.2	0.12
	xdxx	3MT	2m Ct2	Fair	4	2.3	5.8	0.00
Janick (JIK)	xbxx	1	4kx A	Poor	5	95.5	236.1	0.17
	xcxx	2T	4kx Bt2	Poor	5	2.2	5.4	0.00
	xxxx	1	4kx A	Poor	5	473.6	1,170.3	0.82
Justice (JUC)	xbxx	2W	4k A	Poor	5	200.6	495.7	0.35
	xcxx	2WT	4k Bt2	Poor	5	106.3	262.7	0.18
	xxxs	3N	4k A	Poor	5	14.1	34.8	0.02
	xxxx	2W	4k A	Poor	5	194.8	481.3	0.34
Knolls (KLS)	1xxx	3E	2m A	Good	3	16.5	40.9	0.03
Kerran (KRN)	xbxx	5IW	4kw Ci	Poor	5	4.3	10.6	0.01
Kilmury (KUY)	xxxx	3M	2mw A	Good	3	51.9	128.3	0.09
Kleysen (KYS)	1cxx	2T	2kx Bt2	Good	4	61.1	151	0.11
	1xxx	2X	2kx A	Good	4	328.8	812.5	0.57
	xb1x	2X	2kx A	Good	4	10.0	24.8	0.02
	xbxx	2X	2kx A	Good	4	69.7	172.2	0.12
	xc1x	2T	2kx Bt2	Good	4	89.0	220	0.15
	xcxx	2T	2kx Bt2	Good	4	107.8	266.5	0.19
	xxxx	2X	2kx A	Good	4	362.7	896.2	0.63
Lavinia (LAV)	xxxx	2W	3w A	Fair	4	10.9	27	0.02
Lindstrom (LDM)	1c1x	2W	3wx Bt2	Fair	4	2.5	6.3	0.00
	xxxx	2W	3wx A	Fair	4	20.9	51.7	0.04
Levine (LEI)	xbxx	3I	3w Bi	Fair	3	38.6	95.4	0.07
	xxxx	3I	3w Bi	Fair	3	287.1	709.5	0.50
Lockhart (LKH)	1cxx	2MT	2x Bt2	Good	4	15.2	37.5	0.03
Lavenham (LVH)	1cxx	3MW	2mw Bt2	Good	3	16.7	41.4	0.03
	1xxx	3MW	2mw A	Good	3	13.4	33.2	0.02
	xxxx	3MW	2mw A	Good	3	29.5	72.8	0.05
Lowton (LWN)	xbxs	5W	4kw A	Poor	5	6.3	15.6	0.01
	xbxx	5W	4kw A	Poor	5	17.1	42.2	0.03
	xxxs	5W	4kw A	Poor	5	111.7	276.1	0.19
	xxxx	5W	4kw A	Poor	5	113.8	281.3	0.20
Marsden (MDN)	xbxx	5W	4w A	Poor	5	58.3	144	0.10
	xc1s	5W	4w Bt2	Poor	5	4.2	10.4	0.01
	xxxx	5W	4w A	Poor	5	5.7	14	0.01
Mansfield (MFI)	xxxx	4M	4m A	Poor	5	10.7	26.3	0.02
Moore Park (MPK)	xbxx	2W	3w A	Fair	4	17.5	43.4	0.03

Table A2. Ag Capability and Irrigation Suitability of Soils in the RM of Elton (cont'd)

Soil name (Soil code)	Soil phase	Agricultural capability	Irrigation suitability			Total area		% of RM
			Class	General rating	Rating for potato production	ha	ac	
Moore Park (MPK)	xcxx	2W	3w A	Fair	4	3.5	8.7	0.01
Marringhurst (MRH)	1bxx	5M	4m A	Poor	5	4.7	11.7	0.01
	2cxx	5ME	4m Bt2	Poor	5	4.5	11.1	0.01
	xcxx	5M	4m Bt2	Poor	5	10.7	26.4	0.02
	xxxx	5M	4m A	Poor	5	13.1	32.4	0.02
Miniota (MXI)	1cxx	4M	2m Bt2	Good	3	6.3	15.5	0.01
	xbxx	4M	2m A	Good	3	72.1	178	0.12
	xcxx	4M	2m Bt2	Good	3	16.6	41	0.03
	xxxx	4M	2m A	Good	3	57.2	141.4	0.10
Melland (MXT)	xb1x	2M	3w A	Fair	4	16.4	40.5	0.03
	xbxx	2M	3w A	Fair	4	66.5	164.3	0.12
	xc1x	2MT	3w Bt2	Fair	4	11.3	27.9	0.02
	xcxx	2MT	3w Bt2	Fair	4	22.9	56.7	0.04
	xxxx	2M	3w A	Fair	4	7.1	17.5	0.01
Newdale (NDL)	1b1x	2X	2kx A	Good	5	14.4	35.6	0.02
	1c1x	2T	2kx Bt2	Good	4	370.0	914.2	0.64
	1cxx	2T	2kx Bt2	Good	4	1,055.6	2,608.4	1.83
	1dxx	3T	2kx Ct2	Fair	4	6.5	16.1	0.01
	1e1x	4T	2kx Ct2	Fair	5	24.5	60.5	0.04
	xb1x	2X	2kx A	Good	4	86.1	212.8	0.15
	xbxx	2X	2kx A	Good	4	521.3	1,288.2	0.90
	xc1x	2T	2kx Bt2	Good	4	668.4	1,651.7	1.16
	xcxx	2T	2kx Bt2	Good	4	2,507.3	6,195.6	4.34
	xdxx	3T	2kx Ct2	Fair	4	27.1	67	0.05
	xxxx	2X	2kx A	Good	4	5.0	12.3	0.01
Oberon (OBR)	xxxx	2W	3w A	Fair	3	348.9	862	0.60
Prodan (PDA)	1xxs	3N	3sw A	Fair	4	240.8	594.9	0.42
	1xxx	2W	3w A	Fair	3	20.0	49.3	0.03
	xbxs	3N	3sw A	Fair	4	27.0	66.7	0.05
	xbxx	2W	3w A	Fair	3	380.9	941.2	0.66
	xcxx	2WT	3w Bt2	Fair	3	29.7	73.3	0.05
	xxxs	3N	3sw A	Fair	4	422.8	1,044.8	0.73
	xxxx	2W	3w A	Fair	3	377.7	933.2	0.65
Penrith (PEN)	xbxx	5W	4w A	Poor	5	3.7	9.1	0.01
	xxxx	5W	4w A	Poor	5	3.3	8.3	0.01
Perillo (PER)	xxxx	O3W	Organic	ORG	5	95.6	236.3	0.17
Pleasant (PLE)	1cxx	2MT	2w Bt2	Good	3	13.5	33.2	0.02
	xxxx	2M	2w A	Good	3	178.7	441.7	0.31
Porple (POR)	xxxx	3M	1 A	Excellent	1	9.0	22.2	0.02
Poolex (POX)	xxxs	5W	4w A	Poor	5	1.4	3.5	0.00
	xxxx	5W	4w A	Poor	5	14.9	36.9	0.03
Prosser (PSE)	xcxx	3M	1 Bt2	Good	1	5.8	14.4	0.01

Table A2. Ag Capability and Irrigation Suitability of Soils in the RM of Elton (cont'd)

Soil name (Soil code)	Soil phase	Agricultural capability	Irrigation suitability			Total area		% of RM
			Class	General rating	Rating for potato production	ha	ac	
Prosser (PSE)	xxxx	3M	1 A	Excellent	1	21.7	53.7	0.04
Petrel (PTR)	xxxx	2W	2w A	Good	3	0.7	1.7	0.00
Ramada (RAM)	1dxx	3T	2k Ct2	Fair	4	7.4	18.3	0.01
	xbxx	1	2k A	Good	2	762.6	1,884.4	1.32
	xcxx	2T	2k Bt2	Good	2	52.9	130.7	0.09
	xxxx	1	2k A	Good	2	80.2	198.1	0.14
Rempel (RMP)	2d1x	3TE	2k Ct2	Fair	4	0.4	0.9	0.00
Rufford (RUF)	1c1x	2T	2kx Bt2	Good	4	783.7	1,936.6	1.36
	1cxx	2T	2kx Bt2	Good	4	1,313.9	3,246.8	2.27
	1d1x	3T	2kx Ct2	Fair	4	32.8	81.2	0.06
	1dxx	3T	2kx Ct2	Fair	4	31.0	76.5	0.05
	2c1x	2TE	2kx Bt2	Good	4	16.7	41.3	0.03
	2cxx	2TE	2kx Bt2	Good	4	2.6	6.5	0.00
	xb1x	2X	2kx A	Good	4	76.1	188.1	0.13
	xbxx	2X	2kx A	Good	4	501.0	1238	0.87
	xc1x	2T	2kx Bt2	Good	4	206.1	509.4	0.36
	xcxx	2T	2kx Bt2	Good	4	2,068.1	5,110.5	3.58
	xxxx	2X	2kx A	Good	4	25.0	61.8	0.04
Stockton (SCK)	1cxx	4M	2m Bt2	Good	2	21.7	53.6	0.04
	2cxx	4ME	2m Bt2	Good	2	1.7	4.2	0.00
	xxxx	4M	2m A	Good	2	60.3	149.1	0.10
Sigmund (SGO)	xbxx	2W	4kx A	Poor	5	264.6	653.8	0.46
	xcxx	2WT	4kx Bt2	Poor	5	29.8	73.7	0.05
	xxxs	3N	4kx A	Poor	5	705.2	1,742.6	1.22
	xxxx	2W	4kx A	Poor	5	713.2	1,762.4	1.23
Shilox (SHX)	xdxx	6M	3m Ct2	Fair	4	11.1	27.4	0.02
Sutton (SXP)	xbxx	5W	4w A	Poor	5	13.3	32.8	0.02
	xxxs	5W	4w A	Poor	5	30.2	74.7	0.05
	xxxx	5W	4w A	Poor	5	95.9	236.9	0.17
Traverse (TAV)	xcxx	2T	1 Bt2	Good	1	18.4	45.4	0.03
Tadpole (TDP)	xbxx	5W	4w A	Poor	5	74.1	183.1	0.13
	xcxx	5W	4w Bt2	Poor	5	3.6	8.9	0.01
	xxxs	5W	4w A	Poor	5	428.8	1,059.6	0.74
	xxxx	5W	4w A	Poor	5	113.9	281.4	0.20
Taggart (TGR)	1xxx	2W	2w A	Good	3	7.1	17.5	0.01
	xbxx	2W	2w A	Good	3	19.8	48.9	0.03
	xcxx	2WT	2w Bt2	Good	3	8.0	19.7	0.01
	xxxs	3N	3s A	Fair	4	830.8	2,053.1	1.44
	xxxx	2W	2w A	Good	3	428.3	1,058.2	0.74
Torcan (TOC)	xbxx	2W	2w A	Good	3	17.1	42.1	0.03
	xxxs	3N	3s A	Fair	4	134.7	332.9	0.23
	xxxx	2W	2w A	Good	3	231.5	572.1	0.40

Table A2. Ag Capability and Irrigation Suitability of Soils in the RM of Elton (cont'd)

Soil name (Soil code)	Soil phase	Agricultural capability	Irrigation suitability			Total area		% of RM
			Class	General rating	Rating for potato production	ha	ac	
Vordas (VDS)	xbxx	5W	4w A	Poor	5	8.3	20.6	0.01
	xxxs	5W	4w A	Poor	5	28.7	71	0.05
	xxxx	5W	4w A	Poor	5	7.7	18.9	0.01
Vodroff (VFF)	xbxs	5W	4w A	Poor	5	22.3	55.1	0.04
	xbxx	5W	4w A	Poor	5	918.9	2,270.5	1.59
	xcxx	5W	4w Bt2	Poor	5	5.8	14.4	0.01
	xxxs	5W	4w A	Poor	5	1,345.3	3,324.4	2.33
	xxxx	5W	4w A	Poor	5	196.3	485	0.34
Vodroff, peaty (VFFp)	xxxs	6W	4w A	Poor	5	37.8	93.4	0.07
Varcoe (VRC)	1b1x	2W	3w A	Fair	4	0.4	0.9	0.00
	1c1x	2WT	3w Bt2	Fair	4	24.1	59.6	0.04
	1cxx	2WT	3w Bt2	Fair	4	107.5	265.5	0.19
	1dxx	3T	3w Ct2	Fair	4	11.9	29.4	0.02
	xb1s	3N	3sw A	Fair	4	4.7	11.6	0.01
	xb1x	2W	3w A	Fair	4	13.5	33.4	0.02
	xbxs	3N	3sw A	Fair	4	25.9	64	0.04
	xbxx	2W	3w A	Fair	4	1,993.9	4927	3.45
	xc1x	2WT	3w Bt2	Fair	4	47.9	118.4	0.08
	xcxs	3N	3sw Bt2	Fair	4	4.6	11.5	0.01
	xcxx	2WT	3w Bt2	Fair	4	1,400.2	3,459.9	2.42
	xdxx	3T	3w Ct2	Fair	4	16.5	40.7	0.03
	xx1s	3N	3sw A	Fair	4	2.5	6.1	0.00
	xxxs	3N	3sw A	Fair	4	0.5	1.2	0.00
	xxxx	2W	3w A	Fair	4	50.5	124.7	0.09
Woodfield (WDF)	1cxx	2T	2kx Bt2	Good	4	54.6	134.9	0.09
Wheatland (WHL)	1bxx	5M	3m A	Fair	4	31.1	76.8	0.05
	1c1x	5M	3m Bt2	Fair	4	3.5	8.7	0.01
	1cxx	5M	3m Bt2	Fair	4	25.0	61.9	0.04
	xbxx	5M	3m A	Fair	4	53.9	133.1	0.09
	xcxx	5M	3m Bt2	Fair	4	29.3	72.4	0.05
Wytonville (WVI)	xxxx	3M	2mw A	Good	3	15.4	38.1	0.03
Wellwood (WWD)	1cxx	2T	2k Bt2	Good	2	15.0	37.1	0.03
	2dxx	3TE	2k Ct2	Fair	4	38.8	95.8	0.07
	xbxx	1	2k A	Good	2	119.7	295.8	0.21
	xcxx	2T	2k Bt2	Good	2	15.2	37.7	0.03
	xdxx	3T	2k Ct2	Fair	4	20.5	50.7	0.04
	xxxx	1	2k A	Good	2	18.4	45.5	0.03
Xavier (XVI)	xxxx	O3W	Organic	ORG	5	11.8	29.2	0.02
Zarnet (ZRT)	1cxx	3M	2gm Bt2	Good	3	1.4	3.4	0.00
	xbxx	3M	2gm A	Good	3	14.2	35.1	0.02
	xcxx	3M	2gmCt2	Fair	3	39.8	98.3	0.07
Total						**57,776**	**142,767**	**100**

Table A3. Description of Irrigation Suitability Classes

General Rating	Class	Degree of Limitation	Description
Excellent	**1A**	No soil or landscape limitations	These soils are medium textured, well drained and hold adequate available moisture. Topography is level to nearly level. Gravity irrigation methods may be feasible.
Good	**1B** **2A** **2B**	Slight soil and/or landscape limitations	The range of crops that can be grown may be limited. As well, higher development inputs and management are required. Sprinkler irrigation is usually the only feasible method of water application.
Fair	**1C** **2C** **3A** **3B** **3C**	Moderate soil and/or landscape limitations	Limitations reduce the range of crops that may be grown and increase development and improvement costs. Management may include special conservation techniques to minimize soil erosion, limit salt movement, limit water table build-up or flooding of depressional areas. Sprinkler irrigation is usually the only feasible method of water application.
Poor	**1D** **2D** **3D** **4A** **4B** **4C** **4D**	Severe soil and/or landscape limitations	Limitations generally result in a soil that is unsuitable for sustained irrigation. Some land may have limited potential when special crops, irrigation systems, and soil and water conservation techniques are used.

Table A4. Landscape Features Affecting Irrigation Suitability

Symbol	Landscape Features	Degree of Limitation			
		None (A)	Slight (B)	Moderate (C)	Severe (D)
t1	Slope - Simple %	<2	2 - 9	> 9 - 20	>20
t2	- Complex %	<5		> 5 - 15	>15
E	Relief (m) (Average Local)	<1	1 - 3	> 3 - 5	>5
P	Stoniness -Classes -Cover (%)	0, 1 & 2 (0 to 3%)	3 (> 3 to 15%)	4 (> 15 to 50%)	5 (>50)
I	Inundation -Frequency of Flooding (period)	1 in 10 years	1 in 5 years	Every year (annual-spring)	Every year (seasonal)

* Suitability interpretations are based on the criteria for complex slopes.

Table A5. Soil Features Affecting Irrigation Suitability

Symbol	Soil Feature	Degree of Limitation			
		None (1)	Slight (2)	Moderate (3)	Severe (4)
d	Structure	Granular, Single Grained, Prismatic, Blocky, Subangular Blocky	Columnar, Platy	Massive	Massive
k	Ksat (mm/hr) (0 - 1.2 m)	> 50	50 - 15	< 15 - 1.5	< 1.5
x	Drainability (mm/hr) (1.2 - 3 m)	> 15	15 - 5	< 5 - 0.5	< 0.5
m	AWHC subhumid (mm/1.2 m) (% by volume) Subarid (mm/1.2 m) (% by volume)	> 120 (> 10) > 150 (> 12)	120 - 100 (10 - 8) 150 - 120 (12 - 10)	< 100 - 75 (< 8 - 6) < 120 - 100 (< 10 - 8)	< 75 (< 6) < 100 (< 8)
q	Intake Rate (mm/hr)	> 15	15 - 1.5	15 - 1.5	< 1.5
s	Salinity (mS/cm or dS/m) 0 - 0.6 m depth 0.6 - 1.2 m depth 1.2 - 3 m depth	 < 2 < 4 < 8	 2 - 4 4 - 8 8 - 16	 > 4 - 8 > 8 - 16 > 16	 > 8 > 16 > 16
n	Sodicity (SAR) 0 - 1.2 m depth 1.2 - 3 m depth	 < 6 < 6	 6 - 9 6 - 9	 > 9 - 12 > 9 - 12	 > 12 > 12
g	Geological (0 - 1.2 m) Uniformity (1.2 – 3 m)	1 Textural Group 2 Textural Groups	2 Textural Groups Coarser below 3 Textural Groups Coarser below	2 Textural Groups Finer below 3 Textural Groups Coarser below 3 Textural Groups Finer below	3 Textural Groups Finer below
r	Depth to Bedrock (m)	> 3	3 - 2	< 2 - 1	< 1
h	Depth to Water Table (m)	> 2	2 - 1.2 (if salinity is a problem)	2 - 1.2 (if salinity is a problem)	< 1.2
w	Drainage Class	Well, Moderately Well	Imperfect	Imperfect	Poor, Very Poor, Excessive, Rapid
	*Texture (Classes) (0 - 1.2 m)	L, SiL, VFSL, FSL	CL, SiCL, SCL, SL, LVFS	C, SC, SiC VFS, FS, LS, CoSL	HC GR, CoS, LCoS, S
	*Organic Matter %	> 2	2 - 1	2 - 1	< 1
	*Surface Crusting Potential	Slight	Low	Low	Moderate

* Other important factors used to interpret type and degree of limitation, but which do not present a limitation to irrigation themselves. No symbol is proposed for these factors since they will not be identified as subclass limitations.

Table A6. Guidelines for Assessing Land Suitability for Irrigated Potato Production under Rapid, Well and Moderately Well Drained Soils

In assessing suitability of land for irrigated potato production, the degree of suitability is determined by the most restrictive or severe rating assigned to any one of the listed characteristics or properties.

Characteristic or Property	Suitability Rating				
	Class 1	**Class 2**	**Class 3**	**Class 4**	**Class 5**
Texture Group*	CL CL/SF CL/SF/SC CL/FL/SF CL/LY LY/SF LY	SY,SY/SC, SY/CL, SY/LY, SY/FL, SY/SS/LY, SF, SY/UD/LY,SF/CS, SF/SC, SF/LY, SF/FL, SC/LY, SC, SF/SS/FL, CL/FL, SC/FL, CL/SS/FL, LY/FL, LY/SC, LY/LS, LY/SS/SF, LY/SS/SC, LY/FL/SF, LY/SS/LY, LY/SS/FL, FL FL/SF, FL/LY, FL/FL, FL/SY/SF, FL/SS/LY, FL/SS/FL, FL/CL	SY/SS, SY/CY/LY, SF/SS, CL/SS, SF/CY, CL/CY, SF/CY/LY, CL/CY/LY, CL/SS/CY, LY/CY, LY/SS, FL/SS	FL/CY, FL/CY/SF	SK, SS, SS/RK, SS/LY, SS/FL, SS/CY, SC/RK, SF/RK, CS, CL/RK, CL/FR, CL/FR/RK, LS/RK, LY/RK, LY/SY/RK, FL/LY/RK, CY, CY/SS, CY/SC, CY/SY, CY/SF, CY/CL, CY/LY, CY/FL, CY, CY/RK, CY/TX, CY/SS/CY, CY/LY/CY, CY/FL/CY, CY/LY/RK, CY/FL/RK, RK, TX, TX/LY, UD, UD/LY
Topography[1] (Slope)	0 - 5% (a, b, c)			> 5 - 9% (d)	> 9% (e, f, g, h, i)
Stoniness[2] Class	-			St. 1	St. 2, 3, 4, 5
Salinity[3] (mS/cm)	< 2		2 – 4	> 4 - 8	> 8
Soil Order and / or Subgroup			Orthic Regosol		Organic Order, Solonetzic Order, Solonetzic Subgroups

Topography[1]	**Stoniness[2]**	**(Surface covered)**	**Salinity[3]**	**(mS/cm)**
< 5 % level to very gently sloping	- non-stony	(< 0.01 %)	very low	(0 – 2)
5 - 9 % gently sloping	1 slightly stony	(0.01 - 0.1 %)	low	(> 2 – 4)
> 9 % mod. to extremely sloping	2 moderately stony	(> 0.1 - 3 %)	weakly (s)	(> 4 - 8)
	3 very stony	(> 3 - 15 %)	moderately (t)	(> 8 – 16)
	4 exceedingly stony	(> 15 - 50 %)	strongly (u)	(> 16)
	5 excessively stony	(> 50 %)		

* SK = Skeletal
SS = Sandy Skeletal
LS = Loamy Skeletal
CS = Clayey Skeletal
SC = Sandy Coarse
SY = Sandy
SF = Sandy Fine
CL = Coarse Loamy
LY = Loamy
FL = Fine Loamy
CY = Clayey
RK = Bedrock
FR = Fragmental
UD = Undifferentiated
TX = Texture Complex

Table A7. Guidelines for Assessing Land Suitability for Irrigated Potato Production under Imperfectly, Poorly and Very Poorly Drained Soils

In assessing suitability of land for irrigated potato production, the degree of suitability is determined by the most restrictive or severe rating assigned to any one of the listed characteristics or properties.

Characteristic or Property	Suitability Rating				
	Class 1	Class 2	Class 3	Class 4	Class 5
Texture Group*			SY, SY/SS, SY/SC, SY/CL, SY/LY, SC/LY, SY/SS/LY, SY/UD/LY, SC, SF, SF/SS, SF/CS, SF/LY, SF/SC, SF/FL, SY/FL, SF/SS/FL, CL, CL/SS, CL/SF, CL/LY, CL/FL, CL/SF/SC, CL/SS/FL, CL/FL/SF, LY/SS, LY/SC, LY/SF, LY/LS, LY/SS/SF, LY/SF/SC, SC/FL, LY, LY/FL, LY/SS/LY, LY/SS/FL, FL, FL/SF, FL/SS, FL/CL, FL/LY, FL/FL, FL/SY/SF, FL/SS/LY, FL/SS/FL	SF/CY, SY/CY/LYSF/ CY/LY, SF/CY/FL, CL/CY, CL/CY/LY, CL/SS/CY, LY/CY, FL/CY/SF, FL/CY	SK, SS, SS/RK, SS/LY, SS/FL, SS/CY, SC/RK, SF/RK, CS, CL/RK, CL/FR, CL/FR/RK, LS/RK, LY/RK, LY/SY/RK, FL/LY/RK, CY, CY/SS, CY/SC, CY/SY, CY/SF, CY/CL, CY/LY, CY/FL, CY CY/RK, CY/TX, CY/SS/CY, CY/LY/CY, CY/FL/CY, CY/LY/RK, CY/FL/RK, RK, TX, TX/LY, UD, UD/LY
Topography[1] (Slope)			0 - 5%	> 5 - 9%	> 9%
Stoniness[2] Class				St. 1	St. 2, 3, 4, 5
Salinity[3] (mS/cm)			< 4	4 - 8	> 8
Soil Order and / or Subgroup					Organic Order, Gleysolic Order, Solonetzic Order, Solonetzic Subgroups

Topography[1]	Stoniness[2]	(Surface covered)	Salinity[3]	(mS/cm)
< 5 % level to very gently sloping	- non-stony	(< 0.01 %)	very low	(0 – 2)
5 - 9 % gently sloping	1 slightly stony	(0.01 - 0.1 %)	low	(> 2 – 4)
> 9 % mod. to extremely sloping	2 moderately stony	(> 0.1 - 3 %)	weakly (s)	(> 4 – 8)
	3 very stony	(> 3 - 15 %)	Moderately (t)	(> 8 – 16)
	4 exceedingly stony	(> 15 - 50 %)	Strongly (u)	(> 16)
	5 excessively stony	(> 50 %)		

* SK = Skeletal
SS = Sandy Skeletal
LS = Loamy Skeletal
CS = Clayey Skeletal
SC = Sandy Coarse
SY = Sandy
SF = Sandy Fine
CL = Coarse Loamy
LY = Loamy
FL = Fine Loamy
CY = Clayey
RK = Bedrock
FR = Fragmental
UD = Undifferentiated
TX = Texture Complex

Table A8. Suitability Ratings of Soils for Selected Engineering and Recreational Uses in the RM of Elton

Soil name	Soil code	Soil phases	Top soil	Sand & gravel	Road fill	Building - basement		Local roads/ streets	Sanitary trench	Land-fill area	Cover material	Sewage lagoon	Septic field	Play ground	Picnic area	Camp area	Paths & trails
						with	without										
Eroded Slope Complex	$ER	xexx	Vb	Va	-	-	-	-	Vdk	Vk	Pd	Vt	Pk	Vt	Ps	Ps	Fs
Marsh	$MH	xxxx	Vw	Vah	Vhw	Vhw	Vhw	Vaw	Vhw	Vhw	Vw	Vhi	Vhi	Vsw	Vsw	Vsw	Vw
Unclassified land	$UL	xxxx	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water	$ZZ	xxxx	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ashmore	AHO	1c1x	Fb	Faq	G	G	G	G	Vks	Vkg	Pcq	Vak	Gg	Fqt	Fms	G	G
		xxxx	Fb	Faq	G	G	G	G	Vks	Vkg	Pcq	Vak	Gg	Fq	Fms	G	G
Arizona	AIZ	1cxx	Vb	Fa	G	G	G	G	Vks	Vk	Pq	Vk	Gg	Fst	Fms	Fs	Ps
Angusville	ANL	1cxx	Pb	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Ftw	Fw	Fw	Fw
		xbxx	Pb	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fw	Fw	Fw	Fw
		xc1x	Pb	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Fw	Fw	Fw	Fw
		xcxx	Pb	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Ftw	Fw	Fw	Fw
Assiniboine	ASB	xbxx	Ps	Va	Pa	Piw	Pai	Pai	Pis	Pi	Ps	Pi	Vk	Ps	Ps	Pis	Ps
Bankton	BAO	xbxx	Ps	Va	Pa	Pa	Pa	Pa	Ps	G	Ps	G	Vk	Fks	Fs	Fks	Fs
		xcxx	Ps	Va	Pa	Pa	Pa	Pa	Ps	G	Ps	Ft	Vk	Fkt	Fs	Fks	Fs
		xxxx	Ps	Va	Pa	Pa	Pa	Pa	Ps	G	Ps	G	Vk	Fks	Fs	Fks	Fs
Basker	BKR	xbxx	Pi	Va	Pw	Viw	Vi	Vi	Viw	Viw	Pw	Vi	Vhi	Viw	Piw	Viw	Piw
		xxxx	Pi	Va	Pw	Viw	Vi	Vi	Viw	Viw	Pw	Vi	Vhi	Viw	Piw	Viw	Piw
Bermont	BMN	1b1x	Fb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
		1bxx	Fb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
		1c1x	Fb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		1cxx	Fb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		1d1x	Fbt	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
		1dxx	Fbt	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs
		2d1x	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
		2dxx	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs
		xb1x	Fbs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
		xbxx	Fbs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
		xc1x	Fbs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fst	Fs	Fs	Fs
		xcxx	Fbs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
Beresford	BSF	1b1x	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
		1bxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
		1c1x	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Ftw	Fsw	Fsw	Fsw
		1cxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Ftw	Fsw	Fsw	Fsw
		1xxs	Pbn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fnw	Fnw	Fnw	Fsw
		1xxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
		xb1s	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fnw	Fnw	Fnw	Fsw
		xb1x	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
		xbxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fnw	Fnw	Fnw	Fsw
		xbxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
		xc1s	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Fnt	Fnw	Fnw	Fsw

Table A8. Suitability Ratings of Soils for Selected Engineering and Recreational Uses in the RM of Elton (cont'd)

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						with	without										
Beresford	BSF	xc1x	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Ftw	Fsw	Fsw	Fsw
		xcxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Ftw	Fsw	Fsw	Fsw
		xdxx	Fst	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Pt	Phk	Pt	Fsw	Fsw	Fsw
		xxxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fnw	Fnw	Fnw	Fsw
		xxxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
Barwood	BWO	1cxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Ftw	Fsw	Fsw	Fsw
		xbxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
		xb1x	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
		xc1x	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Ftw	Fsw	Fsw	Fsw
		xcxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Ftw	Fsw	Fsw	Fsw
		xxxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
Carvey	CAV	xbxx	Fs	Fhq	Pw	Vhw	Phw	Pw	Vwg	Vhk	Pqw	Vkg	Vhg	Pw	Pw	Pw	Pw
		xxxx	Fs	Fhq	Pw	Vhw	Phw	Pw	Vwg	Vhk	Pqw	Vkg	Vhg	Pw	Pw	Pw	Pw
Carvey, peaty	CAV	xxxx	Vw	Vhq	Vw	Vhw	Vaw	Pw	Vwg	Vhw	Vsw	Vkg	Vhg	Vsw	Vsw	Vsw	Vs
Cobfield	CBF	1cxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
		xb1x	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
		xbxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fnw	Fnw	Fnw	Fsw
		xbxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
		xc1x	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Ftw	Fsw	Fsw	Fsw
		xcxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Ftw	Fsw	Fsw	Fsw
		xxxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
Chambers	CBS	1b1x	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
		1bxx	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
		1c1x	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		1cxx	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		1dxx	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs
		1xxx	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
		2cxx	Vb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		xb1x	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
		xbxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
		xc1x	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		xcxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		xdxx	Fst	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs
		xxxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
Cactus	CCS	2cxx	Vb	Pa	G	G	G	G	Vks	Vkg	Pq	Vkg	Gg	Fst	Fms	Fs	G
		2xxx	Vb	Pa	G	G	G	G	Vks	Vkg	Pq	Vkg	Gg	Fms	Fms	Fs	G
Crookdale	CKD	1xxx	Fbs	Va	Faw	Pw	Faw	Faw	Vks	Fwg	Pq	Pkg	Fhg	Fsw	Fsw	Fsw	Fsw
		xbxx	Fbs	Va	Faw	Pw	Faw	Faw	Vks	Fwg	Pq	Pkg	Fhg	Fsw	Fsw	Fsw	Fsw
		xxxx	Fbs	Va	Faw	Pw	Faw	Faw	Vks	Fwg	Pq	Pkg	Fhg	Fsw	Fsw	Fsw	Fsw

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						with	without										
Clementi	CLN	1b1x	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
		1c1x	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fs	Fs	Fs	Fs
		1cxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		1xxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fst	Fs	Fs	Fs
		2c1x	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Pt	Fs	Fs	Fs
		xb1x	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
		xbxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fst	Fs	Fs	Fs
		xc1x	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fs	Fs	Fs	Fs
		xcxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fs	Fs	Fs	Fs
		xd1x	Fst	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Fst	Fs	Fs	Fs
		xxxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fst	Fs	Fs	Fs
Cordova	CVA	1c1x	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Pt	Fs	Fs	Fs
		1cxx	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fs	Fs	Fs	Fs
		1d1x	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Fst	Fms	Fs	G
		xbxx	Fbs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fms	Fms	Fs	G
		xc1x	Fbs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fsw	Fsw	Fsw	Fsw
		xcxx	Fbs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fsw	Fsw	Fsw	Fsw
		xxxx	Fbs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fsw	Fsw	Fsw	Fsw
Carroll	CXF	1cxx	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fs	Fs	Fs	Fs
		xbxx	Fbs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fst	Fs	Fs	Fs
Capell	CXT	xb1x	Fbs	Faq	Fw	Pw	Faw	Faw	Vks	Pkg	Pcq	Vak	Phg	Fst	Fs	Fs	Fs
		xbxx	Fbs	Faq	Fw	Pw	Faw	Faw	Vks	Pkg	Pcq	Vak	Phg	Fsw	Fsw	Fsw	Fsw
		xcxx	Fbs	Faq	Fw	Pw	Faw	Faw	Vks	Pkg	Pcq	Vak	Phg	Ftw	Fsw	Fsw	Fsw
		xxxs	Pn	Faq	Fw	Pw	Faw	Faw	Vks	Pkg	Pcq	Vak	Phg	Fnw	Fnw	Fnw	Fsw
		xxxx	Fbs	Faq	Fw	Pw	Faw	Faw	Vks	Pkg	Pcq	Vak	Phg	Fsw	Fsw	Fsw	Fsw
Charman	CXV	xbxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fnw	Fnw	Fnw	Fsw
		xbxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
		xcxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Ftw	Fsw	Fsw	Fsw
		xxxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
Croyon	CYN	1cxx	Pb	Faq	G	G	Fa	Fa	Vks	Pkg	Pcq	Vak	Gg	Ft	G	G	G
		xbxx	Fb	Faq	G	G	Fa	Fa	Vks	Pkg	Pcq	Vak	Gg	Fs	Fs	Fs	Fs
		xc1x	Fb	Faq	G	G	Fa	Fa	Vks	Pkg	Pcq	Vak	Gg	Ft	G	G	G
		xcxx	Fb	Faq	G	G	Fa	Fa	Vks	Pkg	Pcq	Vak	Gg	Ft	G	G	G
Dogand	DGA	xbxx	Fbs	Pax	Fa	Fa	Fa	Fa	Fsg	Gg	Fcs	Pkg	Gg	Fs	Fs	Fs	Fs
		xcxx	Fbs	Pax	Fa	Fa	Fa	Fa	Fsg	Gg	Fcs	Pkg	Gg	Fst	Fs	Fs	Fs
Dorset	DOT	1bxx	Pbs	G	G	G	G	G	Vks	Vkg	Vcs	Vck	Gg	Pq	Fms	Fs	G
		xbxx	Pbs	G	G	G	G	G	Vks	Vkg	Vcs	Vck	Gg	Pq	Fms	Fs	G
		xcxx	Pbs	G	G	G	G	G	Vks	Vkg	Vcs	Vck	Gg	Pq	Fms	Fs	G
Durnan	DRN	1cxx	Pb	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Fkg	Fk	Fst	Fs	Fs	Fs

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						with	without										
Durnan	DRN	xxxx	Fb	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Fak	Fk	Fs	Fs	Fs	Fs
Drokan	DRO	xbxs	Pn	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Fs	Fs	Fs	Fs
		xbxx	Fs	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
		xcxx	Fs	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
		xxxs	Pn	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
		xxxx	Fs	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
Druxman	DXM	xbxx	Fb	Faq	Faw	Pw	Faw	Faw	Vks	Pkg	Pcq	Vak	Phg	Pw	Pw	Pw	Pw
Everton	EVO	1xxx	Ps	Va	Pa	Pa	Pa	Pa	Ps	G	Ps	Fjk	Pk	Fw	Fw	Fw	Fw
		xbxx	Ps	Va	Pa	Pa	Pa	Pa	Ps	G	Ps	Fjk	Pk	Fs	Fs	Fs	Fs
		xcxx	Ps	Va	Pa	Pa	Pa	Pa	Ps	G	Ps	Fjt	Pk	Fs	Fs	Fs	Fs
		xxxx	Ps	Va	Pa	Pa	Pa	Pa	Ps	G	Ps	Fjk	Pk	Fs	Fs	Fs	Fs
Fenton	FET	xbxs	Pns	Va	Paw	Vw	Paw	Paw	Vhw	Pw	Psw	Ph	Vh	Fs	Fs	Fs	Fs
		xbxx	Ps	Va	Paw	Vw	Paw	Paw	Vhw	Pw	Psw	Ph	Vh	Psw	Psw	Psw	Psw
		xcxx	Ps	Va	Paw	Vw	Paw	Paw	Vhw	Pw	Psw	Ph	Vh	Psw	Psw	Psw	Psw
		xxxs	Pns	Va	Paw	Vw	Paw	Paw	Vhw	Pw	Psw	Ph	Vh	Psw	Psw	Psw	Psw
		xxxx	Ps	Va	Paw	Vw	Paw	Paw	Vhw	Pw	Psw	Ph	Vh	Psw	Psw	Psw	Psw
Fairland	FND	1cxx	Fb	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Fkg	Fk	Psw	Psw	Psw	Psw
		1dxx	Fbt	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Ptg	Fk	Ft	G	G	G
		1xxx	Fb	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Fkg	Fk	Pt	G	G	G
		xbxx	G	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Fkg	Fk	G	G	G	G
		xcxx	G	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Fkg	Fk	G	G	G	G
		xxxx	G	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Fkg	Fk	Ft	G	G	G
Forrest	FRT	xbxx	Ps	Va	Pa	Paw	Pa	Pa	Psw	Fw	Ps	Fjk	Pk	G	G	G	G
		xcxx	Ps	Va	Pa	Paw	Pa	Pa	Psw	Fw	Ps	Fjt	Pk	Ps	Ps	Ps	Ps
		xxxs	Pns	Va	Pa	Paw	Pa	Pa	Psw	Fw	Ps	Fjk	Pk	Ps	Ps	Ps	Ps
		xxxx	Ps	Va	Pa	Paw	Pa	Pa	Psw	Fw	Ps	Fjk	Pk	Ps	Ps	Ps	Ps
Glenboro	GBO	1bxx	Fb	Faq	G	G	Fa	G	Vks	Gg	Pq	Vkg	Gg	Ps	Ps	Ps	Ps
		1cxx	Fb	Faq	G	G	Fa	G	Vks	Gg	Pq	Vkg	Gg	G	G	G	G
		xcxx	G	Faq	G	G	Fa	G	Vks	Gg	Pq	Vkg	Gg	Ft	G	G	G
		xbxx	G	Faq	G	G	Fa	G	Vks	Gg	Pq	Vkg	Gg	Ft	G	G	G
		xcxx	G	Faq	G	G	Fa	G	Vks	Gg	Pq	Vkg	Gg	G	G	G	G
		xxxx	G	Faq	G	G	Fa	G	Vks	Gg	Pq	Vkg	Gg	Ft	G	G	G
Gendzel	GDZ	1cxx	Ps	G	Fw	Pw	Fw	Fw	Vks	Vkg	Pq	Vkg	Phg	Ftw	Fsw	Fsw	Fw
Gregg	GRG	xbxx	Fs	Va	Faw	Pw	Faw	Faw	Pwg	Fwg	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
		xxxx	Fs	Va	Faw	Pw	Faw	Faw	Pwg	Fwg	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
Grover	GRO	xxxx	G	Faq	Faw	Pw	Faw	Faw	Vks	Fwg	Pq	Vkg	Fhg	Fw	Fw	Fw	Fw
Gateside	GTD	xxxs	Pn	Va	Faw	Pw	Faw	Faw	Pkw	Fwg	G	Pk	Fh	Fnw	Fnw	Fnw	Fw
		xxxx	G	Va	Faw	Pw	Faw	Faw	Pkw	Fwg	G	Pk	Fh	Fw	Fw	Fw	Fw
Grayson	GYS	xxxx	G	Phq	Pw	Vhw	Phw	Pfw	Vwg	Pwg	Pqw	Vkg	Vhg	Pw	Pw	Pw	Pw

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						with	without										
Hilton	HIT	1c1x	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Ft	Fs	Fs	Fs
		1cxx	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Ft	Fs	Fs	Fs
		1xxx	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
		xbxx	Fb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	G	G	G	G
		xc1x	Fb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Ft	G	G	G
		xcxx	Fb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Ft	G	G	G
		xxxx	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	G	G	G	G
Hickson	HKS	xbxx	Fb	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
		xxxx	Fb	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
Harding	HRG	xbxx	Ps	Va	Pa	Paw	Pa	Pa	Psw	Fw	Ps	G	Vk	Pks	Psw	Pks	Ps
		xcxx	Ps	Va	Pa	Paw	Pa	Pa	Psw	Fw	Ps	Ft	Vk	Pks	Psw	Pks	Ps
		xxxs	Pn	Va	Pa	Paw	Pa	Pa	Psw	Fw	Ps	G	Vk	Pks	Psw	Pks	Ps
		xxxx	Ps	Va	Pa	Paw	Pa	Pa	Psw	Fw	Ps	G	Vk	Pks	Psw	Pks	Ps
Jaymar	JAY	xb1x	Fb	Pax	Fa	Fa	Fa	Fa	Fsg	Gg	Fcs	Pkg	Gg	G	G	G	G
		xbxx	Fb	Pax	Fa	Fa	Fa	Fa	Fsg	Gg	Fcs	Pkg	Gg	G	G	G	G
		xc1x	Fb	Pax	Fa	Fa	Fa	Fa	Fsg	Gg	Fcs	Pkg	Gg	Ft	G	G	G
		xcxx	Fb	Pax	Fa	Fa	Fa	Fa	Fsg	Gg	Fcs	Pkg	Gg	Ft	G	G	G
		xdxx	Fbt	Pax	Fa	Fa	Fa	Fa	Fsg	Gg	Fcs	Pkt	Gg	Pt	G	G	G
Janick	JIK	xbxx	Ps	Va	Pa	Pa	Pa	Pa	Ps	G	Ps	G	Vk	Fks	Fs	Fks	Fs
		xcxx	Ps	Va	Pa	Pa	Pa	Pa	Ps	G	Ps	Ft	Vk	Fst	Fs	Fks	Fs
		xxxx	Ps	Va	Pa	Pa	Pa	Pa	Ps	G	Ps	G	Vk	Fks	Fs	Fks	Fs
Justice	JUC	xbxx	Ps	Va	Pa	Paw	Pa	Pa	Psw	Fw	Ps	Fjk	Pk	Ps	Ps	Ps	Ps
		xcxx	Ps	Va	Pa	Paw	Pa	Pa	Psw	Fw	Ps	Fjt	Pk	Ps	Ps	Ps	Ps
		xxxs	Pns	Va	Pa	Paw	Pa	Pa	Psw	Fw	Ps	Fjk	Pk	Ps	Ps	Ps	Ps
		xxxx	Ps	Va	Pa	Paw	Pa	Pa	Psw	Fw	Ps	Fjk	Pk	Ps	Ps	Ps	Ps
Knolls	KLS	1xxx	Vb	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Fkg	Fk	G	G	G	G
Kerran	KRN	xbxx	Pis	Va	Paw	Viw	Vi	Vi	Viw	Viw	Psw	Vi	Vhi	Viw	Piw	Viw	Piw
Kilmury	KUY	xxxx	Fb	Faq	Fw	Pw	Faw	Fw	Vks	Vkg	Pcq	Vak	Phg	Fqw	Fw	Fw	Fw
Kleysen	KYS	1cxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		1xxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
		xb1x	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
		xbxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
		xc1x	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		xcxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		xxxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
Lavinia	LAV	xxxx	Fbs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
Lindstrom	LDM	1c1x	Pb	Vax	Faw	Pw	Fw	Fw	Pw	Fw	G	Fk	Ph	Fw	Fw	Fw	Fw
		xxxx	Fb	Vax	Faw	Pw	Fw	Fw	Pw	Fw	G	Fk	Ph	Fw	Fw	Fw	Fw
Levine	LEI	xbxx	Fis	Va	Faw	Piw	Pi	Pi	Piw	Pi	Fs	Pi	Phi	Fiw	Fsw	Pi	Fsw
		xxxx	Fis	Va	Faw	Piw	Pi	Pi	Piw	Pi	Fs	Pi	Phi	Fiw	Fsw	Pi	Fsw

Table A8. Suitability Ratings of Soils for Selected Engineering and Recreational Uses in the RM of Elton (cont'd)

Soil name	Soil code	Soil phases	Top soil	Sand & gravel	Road fill	Building - basement		Local roads/ streets	Sanitary trench	Land-fill area	Cover material	Sewage lagoon	Septic field	Play ground	Picnic area	Camp area	Paths & trails
						with	without										
Lockhart	LKH	1cxx	Pb	Vax	Fa	Fa	Fa	G	Fs	G	G	Fkt	Fk	Ft	G	G	G
Lavenham	LVH	1cxx	Pbs	Pa	Fw	Pw	Fw	Fw	Vks	Vkg	Pq	Vkg	Fhg	Ftw	Fsw	Fsw	Fw
		1xxx	Pbs	Pa	Fw	Pw	Fw	Fw	Vks	Vkg	Pq	Vkg	Fhg	Fsw	Fsw	Fsw	Fw
		xxxx	Ps	Pa	Fw	Pw	Fw	Fw	Vks	Vkg	Pq	Vkg	Fhg	Fsw	Fsw	Fsw	Fw
Lowton	LWN	xbxs	Pns	Va	Paw	Vw	Paw	Paw	Vhw	Pw	Psw	G	Vhk	Psw	Psw	Psw	Psw
		xbxx	Ps	Va	Paw	Vw	Paw	Paw	Vhw	Pw	Psw	G	Vhk	Psw	Psw	Psw	Psw
		xxxs	Pns	Va	Paw	Vw	Paw	Paw	Vhw	Pw	Psw	G	Vhk	Psw	Psw	Psw	Psw
		xxxx	Ps	Va	Paw	Vw	Paw	Paw	Vhw	Pw	Psw	G	Vhk	Psw	Psw	Psw	Psw
Marsden	MDN	xbxx	Fb	Pax	Pw	Vw	Pw	Pw	Vwg	Phw	Pw	Pkg	Vhg	Pw	Pw	Pw	Pw
		xc1s	Pn	Pax	Pw	Vw	Pw	Pw	Vwg	Phw	Pw	Pkg	Vhg	Pw	Pw	Pw	Pw
		xxxx	Fb	Pax	Pw	Vw	Pw	Pw	Vwg	Phw	Pw	Pkg	Vhg	Pw	Pw	Pw	Pw
Mansfield	MFI	xxxx	Ps	G	Fw	Pw	Fw	Fw	Vks	Vkg	Vcs	Vck	Fhg	Pq	Fsw	Fsw	Fw
Moore Park	MPK	xbxx	Fbs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
		xcxx	Fbs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
Marringhurst	MRH	1bxx	Pbs	G	G	G	G	G	Vks	Vkg	Vcs	Vck	Gg	Pq	Fms	Fs	G
		2cxx	Vb	G	G	G	G	G	Vks	Vkg	Vcs	Vck	Gg	Pq	Fms	Fs	G
		xcxx	Pbs	G	G	G	G	G	Vks	Vkg	Vcs	Vck	Gg	Pq	Fms	Fs	G
		xxxx	Pbs	G	G	G	G	G	Vks	Vkg	Vcs	Vck	Gg	Pq	Fms	Fs	G
Miniota	MXI	1cxx	Fb	Faq	G	G	G	G	Vks	Vkg	Pcq	Vak	Gg	Fqt	Fms	G	G
		xbxx	Fb	Faq	G	G	G	G	Vks	Vkg	Pcq	Vak	Gg	Fq	Fms	G	G
		xcxx	Fb	Faq	G	G	G	G	Vks	Vkg	Pcq	Vak	Gg	Fqt	Fms	G	G
		xxxx	Fb	Faq	G	G	G	G	Vks	Vkg	Pcq	Vak	Gg	Fq	Fms	G	G
Melland	MXT	xb1x	Fb	Pax	Faw	Pw	Faw	Faw	Pwg	Fwg	Fcs	Pkg	Fhg	Fw	Fw	Fw	Fw
		xbxx	Fb	Pax	Faw	Pw	Faw	Faw	Pwg	Fwg	Fcs	Pkg	Fhg	Fw	Fw	Fw	Fw
		xc1x	Fb	Pax	Faw	Pw	Faw	Faw	Pwg	Fwg	Fcs	Pkg	Fhg	Ftw	Fw	Fw	Fw
		xcxx	Fb	Pax	Faw	Pw	Faw	Faw	Pwg	Fwg	Fcs	Pkg	Fhg	Ftw	Fw	Fw	Fw
		xxxx	Fb	Pax	Faw	Pw	Faw	Faw	Pwg	Fwg	Fcs	Pkg	Fhg	Fw	Fw	Fw	Fw
Newdale	NDL	1b1x	Fbs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
		1c1x	Fbs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		1cxx	Fbs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		1dxx	Fst	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs
		1e1x	Pt	Va	Fa	Fat	Fat	Fat	Fs	Ft	Fst	Vt	Pk	Vt	Fst	Fst	Fs
		xb1x	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
		xbxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
		xc1x	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		xcxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		xdxx	Fst	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs
		xxxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
Oberon	OBR	xxxx	Fs	Faq	Faw	Pw	Faw	Faw	Vks	Fwg	Pq	Pkg	Fhg	Fsw	Fsw	Fsw	Fsw
Prodan	PDA	1xxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fnw	Fnw	Fnw	Fsw

Table A8. Suitability Ratings of Soils for Selected Engineering and Recreational Uses in the RM of Elton (cont'd)

Soil name	Soil code	Soil phases	Top soil	Sand & gravel	Road fill	Building - basement		Local roads/ streets	Sanitary trench	Land-fill area	Cover material	Sewage lagoon	Septic field	Play ground	Picnic area	Camp area	Paths & trails
						with	without										
Prodan	PDA	1xxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
		xbxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fnw	Fnw	Fnw	Fsw
		xbxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
		xcxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Ftw	Fsw	Fsw	Fsw
		xxxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fnw	Fnw	Fnw	Fsw
		xxxx	Fs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
Penrith	PEN	xbxx	Fb	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
		xxxx	Fb	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
Perillo	PER	xxxx	Vw	Vah	Vah	Vaw	Vaw	Vaw	Vhw	Vhw	Vsw	Vah	Vh	Vsw	Vsw	Vsw	Vsw
Pleasant	PLE	1cxx	Fb	Va	Fw	Pw	Faw	Faw	Pkw	Pkg	G	Pk	Fh	Ftw	Fw	Fw	Fw
		xxxx	G	Va	Fw	Pw	Faw	Faw	Pkw	Pkg	G	Pk	Fh	Fw	Fw	Fw	Fw
Porple	POR	xxxx	G	Va	G	Fa	Fa	Fa	Pk	Pk	G	Pk	G	G	G	G	G
Poolex	POX	xxxs	Pn	Va	Phw	Vw	Pw	Pw	Vhw	Pkw	Pw	Vh	Vh	Pw	Pw	Pw	Pw
		xxxx	Fb	Va	Phw	Vw	Pw	Pw	Vhw	Pkw	Pw	Vh	Vh	Pw	Pw	Pw	Pw
Prosser	PSE	xcxx	G	Va	G	Fa	Fa	Fa	Pk	Pk	G	Pk	G	Ft	G	G	G
		xxxx	G	Va	G	Fa	Fa	Fa	Pk	Pk	G	Pk	G	G	G	G	G
Petrel	PTR	xxxx	G	Faq	Faw	Pw	Faw	Faw	Vks	Fwg	Pq	Vkg	Fhg	Fw	Fw	Fw	Fw
Ramada	RAM	1dxx	Fst	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs
		xbxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
		xcxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		xxxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
Rempel	RMP	2d1x	Vb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs
Rufford	RUF	1c1x	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		1cxx	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		1d1x	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs
		1dxx	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Pt	Pk	Pt	Fs	Fs	Fs
		2c1x	Vb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		2cxx	Vb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		xb1x	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
		xbxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
		xc1x	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		xcxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
		xxxx	Fs	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fak	Pk	Fs	Fs	Fs	Fs
Stockton	SCK	1cxx	Ps	Pa	G	G	G	G	Vks	Vkg	Pq	Vkg	Gg	Fst	Fms	Fs	G
		2cxx	Pbs	Pa	G	G	G	G	Vks	Vkg	Pq	Vkg	Gg	Fst	Fms	Fs	G
		xxxx	Ps	Pa	G	G	G	G	Vks	Vkg	Pq	Vkg	Gg	Fms	Fms	Fs	G
Sigmund	SGO	xbxx	Ps	Va	Pa	Paw	Pa	Pa	Psw	Fw	Ps	G	Vk	Pks	Psw	Pks	Ps
		xcxx	Ps	Va	Pa	Paw	Pa	Pa	Psw	Fw	Ps	Ft	Vk	Pks	Psw	Pks	Ps
		xxxs	Pn	Va	Pa	Paw	Pa	Pa	Psw	Fw	Ps	G	Vk	Pks	Psw	Pks	Ps
		xxxx	Ps	Va	Pa	Paw	Pa	Pa	Psw	Fw	Ps	G	Vk	Pks	Psw	Pks	Ps

Table A8. Suitability Ratings of Soils for Selected Engineering and Recreational Uses in the RM of Elton (cont'd)

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						with	without										
Shilox	SHX	xdxx	Vb	Fa	G	G	G	G	Vks	Vk	Pq	Vkg	Gg	Pmt	Pm	Fs	Ps
Sutton	SXP	xbxx	Fs	Fq	Pw	Vhw	Phw	Pw	Vhw	Pwg	Pqw	Vhg	Vhg	Pw	Pw	Pw	Pw
		xxxs	Pn	Fq	Pw	Vhw	Phw	Pw	Vhw	Pwg	Pqw	Vhg	Vhg	Pw	Pw	Pw	Pw
		xxxx	Fs	Fq	Pw	Vhw	Phw	Pw	Vhw	Pwg	Pqw	Vhg	Vhg	Pw	Pw	Pw	Pw
Traverse	TAV	xcxx	G	Va	Fa	Fa	Fa	Fa	Gg	Gg	G	Fkg	Fk	Fst	Fs	Fs	Fs
Tadpole	TDP	xbxx	Fs	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
		xcxx	Fs	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
		xxxs	Pn	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
		xxxx	Fs	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
Taggart	TGR	1xxx	G	Va	Faw	Pw	Faw	Faw	Pwg	Fwg	G	Fkg	Ph	Fw	Fw	Fw	Fw
		xbxx	G	Va	Faw	Pw	Faw	Faw	Pwg	Fwg	G	Fkg	Ph	Fw	Fw	Fw	Fw
		xcxx	G	Va	Faw	Pw	Faw	Faw	Pwg	Fwg	G	Fkg	Ph	Ftw	Fw	Fw	Fw
		xxxs	Pn	Va	Faw	Pw	Faw	Faw	Pwg	Fwg	G	Fkg	Ph	Fnw	Fnw	Fnw	Fw
		xxxx	G	Va	Faw	Pw	Faw	Faw	Pwg	Fwg	G	Fkg	Ph	Fw	Fw	Fw	Fw
Torcan	TOC	xbxx	G	Va	Faw	Pw	Faw	Faw	Pwg	Fwg	G	Fkg	Ph	Fw	Fw	Fw	Fw
		xxxs	Pn	Va	Faw	Pw	Faw	Faw	Pwg	Fwg	G	Fkg	Ph	Fnw	Fnw	Fnw	Fw
		xxxx	G	Va	Faw	Pw	Faw	Faw	Pwg	Fwg	G	Fkg	Ph	Fw	Fw	Fw	Fw
Vordas	VDS	xbxx	G	Va	Pw	Vw	Pw	Pw	Vhw	Pwg	Pw	Ph	Vh	Pw	Pw	Pw	Pw
		xxxs	Pn	Va	Pw	Vw	Pw	Pw	Vhw	Pwg	Pw	Ph	Vh	Pw	Pw	Pw	Pw
		xxxx	G	Va	Pw	Vw	Pw	Pw	Vhw	Pwg	Pw	Ph	Vh	Pw	Pw	Pw	Pw
Vodroff	VFF	xbxs	Pn	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
		xbxx	Fs	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
		xcxx	Fs	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
		xxxs	Pn	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
		xxxx	Fs	Va	Pw	Vw	Pw	Pw	Vhw	Pw	Pw	Ph	Vh	Pw	Pw	Pw	Pw
Vodroff, peaty	VFF	xxxs	Vw	Vah	Vw	Vw	Vaw	Pw	Vhw	Vhw	Vsw	Vah	Vh	Vsw	Vsw	Vsw	Vs
Varcoe	VRC	1b1x	Fbs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
		1c1x	Fbs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Ftw	Fsw	Fsw	Fsw
		1cxx	Fbs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Ftw	Fsw	Fsw	Fsw
		1dxx	Fbt	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Pt	Phk	Pt	Fsw	Fsw	Fsw
		xb1s	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fnw	Fnw	Fnw	Fsw
		xb1x	Fbs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
		xbxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fnw	Fnw	Fnw	Fsw
		xbxx	Fbs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
		xc1x	Fbs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Ftw	Fsw	Fsw	Fsw
		xcxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Fnt	Fnw	Fnw	Fsw
		xcxx	Fbs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fkt	Phk	Ftw	Fsw	Fsw	Fsw
		xdxx	Fst	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Pt	Phk	Pt	Fsw	Fsw	Fsw
		xx1s	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fns	Fnw	Fnw	Fsw
		xxxs	Pn	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Pw	Pw	Pw	Pw

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						with	without										
Varcoe	VRC	xxxx	Fbs	Va	Faw	Pw	Faw	Faw	Pw	Fw	Fs	Fak	Phk	Fsw	Fsw	Fsw	Fsw
Woodfield	WDF	1cxx	Pb	Va	Fa	Fa	Fa	Fa	Fs	G	Fs	Fkt	Pk	Fst	Fs	Fs	Fs
Wheatland	WHL	1bxx	Ps	G	G	G	G	G	Vks	Vkg	Vq	Vkg	Gg	Fms	Fms	Fs	G
		1c1x	Ps	G	G	G	G	G	Vks	Vkg	Vq	Vkg	Gg	Fms	Fms	Fs	G
		1cxx	Ps	G	G	G	G	G	Vks	Vkg	Vq	Vkg	Gg	Fst	Fms	Fs	G
		xbxx	Ps	G	G	G	G	G	Vks	Vkg	Vq	Vkg	Gg	Fms	Fms	Fs	G
		xcxx	Ps	G	G	G	G	G	Vks	Vkg	Vq	Vkg	Gg	Fmt	Fms	Fs	G
Wytonville	WVI	xxxx	Fb	Faq	Fw	Pw	Faw	Fw	Vks	Vkg	Pcq	Vak	Phg	Fqw	Fw	Fw	Fw
Wellwood	WWD	1cxx	Fbs	Faq	Fa	G	Fa	Fa	Vks	Gg	Fs	Pkg	Fkg	Fst	Fs	Fs	Fs
		2dxx	Fbt	Faq	Fa	G	Fa	Fa	Vks	Gg	Fs	Pkt	Fkg	Pt	Fs	Fs	Fs
		xbxx	Fs	Faq	Fa	G	Fa	Fa	Vks	Gg	Fs	Pkg	Fkg	Fs	Fs	Fs	Fs
		xcxx	Fs	Faq	Fa	G	Fa	Fa	Vks	Gg	Fs	Pkg	Fkg	Fst	Fs	Fs	Fs
		xdxx	Fst	Faq	Fa	G	Fa	Fa	Vks	Gg	Fs	Pkt	Fkg	Pt	Fs	Fs	Fs
		xxxx	Fs	Faq	Fa	G	Fa	Fa	Vks	Gg	Fs	Pkg	Fkg	Fs	Fs	Fs	Fs
Xavier	XVI	xxxx	Vw	Vah	Vaw	Vaw	Vaw	Vaw	Vhw	Vhw	Vsw	Vah	Vhg	Vsw	Vsw	Vsw	Vsw
Zarnet	ZRT	1cxx	Fb	Fq	G	G	Fa	Fa	Vks	Pkg	Pcq	Vak	Gg	Ft	G	G	G
		xbxx	Fb	Fq	G	G	Fa	Fa	Vks	Pkg	Pcq	Vak	Gg	G	G	G	G
		xcxx	Fb	Fq	G	G	Fa	Fa	Vks	Pkg	Pcq	Vak	Gg	Ft	G	G	G

Table A9. Guide for Assessing Soil Suitability as a Source of Topsoil

The term topsoil includes soil materials used to cover barren surfaces exposed during construction, and materials used to improve soil conditions on areas such as lawns, gardens, and flower beds. The factors to be considered include not only the characteristic of the soil itself, but also the ease or difficulty of excavation, and where removal of topsoil is involved, accessibility to the site.

Symbol[1]	Property Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
u	**Moist Consistence[2]**	Very friable, friable	Loose, firm	Very firm	Cemented
i	**Flooding**	None	May flood occasionally for short periods	Frequent flooding (every year)	Constantly flooding
w	**Wetness[2]**	Wetness is not determining if better than very poorly drained.			Very poorly drained and permanently wet soils
t	**Slope**	≤5 % (a, b, c)	> 5 - 9% (d)	> 9 - 15% (e)	> 15% (f, g, h, i)
p	**Stoniness[2]**	Stones > 10 m apart (Class 0 and 1)	Stones > 2 - 10 m apart (Class 2)	Stones 0.1 - 2 m apart (Class 3 and 4)	Stones < 0.1 m apart (Class 5)
c	**Coarse fragments[2] (% by volume)**	≤ 3%	> 3 - 15%	> 15 - 35%	> 35%
s	**Texture[2]**	SL, FSL, VFSL, L, SiL; SC if 1:1 clay is dominant	SCL, CL, SiCL; SC if 2:1 clay is dominant; C and SiC if 1:1 clay is dominant	S, LS; SiC and C if 2:1 clay is dominant. organic soils[3]	Marl, diatomaceous earth
b	**Depth of Topsoil[4]**	> 40 cm	> 15 - 40 cm	8 - 15 cm	< 8 cm
n	**Salinity of Topsoil[5]**	EC < 1	EC 1 - 4	EC > 4 - 8 (s)	EC > 8 (t, u)

1 The symbol is used to indicate the property affecting use.
2 For an explanation of texture, consistence, stoniness, coarse fragments and soil drainage classes, see the Manual for Describing Soils in the Field (Soil and Landscape Management Section, Manitoba Agriculture, Food and Rural Initiatives and Land Resource Unit, Agriculture and Agri-Food Canada, 2007).
3 Non-woody organic materials are assessed as good sources for topsoil if mixed with or incorporated into mineral soil.
4 The remaining soil material (at least 8 cm) must be reclaimable after the uppermost soil is removed.
5 EC = Electrical Conductivity (milliSiemens/cm).

Additional Notes:
Well drained Till soils with erosion 1, rated as **Fb** for depth of topsoil; erosion 2 rated as **Pb** for depth of topsoil; and erosion 3 rated as **Vb** for depth of topsoil.
Well drained Luvisols and Dark Gray Chernozems with erosion 2 or 3 rated as **Vb** for depth of topsoil.
Regosols rated as **Vb** for depth of topsoil.
Poorly drained Organic soils rated as **Vw** for topsoil and Organic soils, drained phase, are rated as **Ps** for topsoil.

Table A10. Guide for Assessing Soil Suitability as a Source of Sand and Gravel

The purpose of this table is to provide guidance for assessing the probable supply as well as quality of the sand or gravel for use as road base material and in concrete. The interpretation pertains mainly to the characteristics of substratum to a depth of 150 cm, augmented by observations made in deep cuts, as well as geological knowledge, where available.

Symbol[1]	Property Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
a	Unified Soil Group [2]	GW GP SW SP	GW - GM GP - GM SW - SM SP – SM	GM GW - GC GP - GC SM SW - SC SP -SC	All other groups and bedrock (ML, CL, OL, MH, CH, OH, PT)
h	Depth to Seasonal Water Table	Not class determining if deeper than 50 cm		< 50 cm	
q	Depth to Sand and Gravel	< 25 cm	25 - 75 cm [3]	> 75 cm [3]	
p	Stoniness[4]	Not class determining if stones > 0.5 m apart (Class 0, 1, 2 and 3)		Stones 0.1 - 0.5 m apart (Class 4)	Stones < 0.1 m apart (Class 5)
d	Depth to Bedrock	> 100 cm	50 - 100 cm	< 50 cm	
x	Thickness of sand and gravel	> 100 cm	50 - 100 cm	< 50 cm	

1 The symbol is used to indicate the property affecting use.
2 Shaly gravels rated as Poor (Pa). Meanings of the definition letters can be found at http://en.wikipedia.org/wiki/Unified_Soil_Classification_System
3 Rated good if it is known that the underlying gravel or sand deposit is thick (> 100 cm).
4 For an explanation of stoniness and rockiness, see the Manual for Describing Soils in the Field (Soil and Landscape Management Section, Manitoba Agriculture, Food and Rural Initiatives and Land Resource Unit, Agriculture and Agri-Food Canada, 2007).

Table A11. Guide for Assessing Soil Suitability as a Source of Road fill

Fill material for building or roads are included in this use. The performance of the material when removed from its original location and placed under load at the building site or road bed are to be considered. **Since surface materials are generally removed during road or building construction, their properties are disregarded**. Aside from this layer, **the whole soil to a depth of 150 to 200 cm should be evaluated.** Soil materials that are suitable for fill can be considered equally suited for road subgrade construction.

Symbol[1]	Property Affecting Use[2]	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
a	**Subgrade[3]** **a.) AASHO Group Index[4]**	< 5	5 - 8	> 8	
	b.) Unified Soil Group	GW, GP, SW, SP, SM, GC[5] and SC[5]	CL (with P.I.[6] <15) and ML	CL (with P.I.[6] of 15 or more), CH and MH[7]	OL, OH and PT
l	**Shrink-swell potential**	Low	Moderate	High	
f	**Susceptibility to frost action[8]**	Low	Moderate	High	
t	**Slope**	≤15% (a, b, c, d, e)	> 15 - 30% (f)	> 30 - 45% (g)	> 45% (h, i)
p	**Stoniness[9]**	Stones > 2 m apart (Class 0, 1 and 2)	Stones > 0.5 - 2 m apart (Class 3)	Stones 0.1 - 0.5 m apart (Class 4)	Stones < 0.1 m apart (Class 5)
r	**Rockiness[9]**	Rock exposures > 35 m apart and cover < 10% of the surface	Rock exposure > 10 - 35 m apart and cover 10 - 25% of the surface	Rock exposure 3.5 - 10 m apart and cover > 25 - 50% of the surface	Rock exposure < 3.5 m apart and cover > 50 - 90% of the surface
w	**Wetness[9]**	Excessively drained to moderately well drained	Imperfectly drained	Poorly drained	Very poorly drained or permanently wet soils
d	**Depth to Bedrock**	> 100 cm	> 50 - 100 cm	20 - 50 cm	< 20 cm
h	**Depth to Seasonal Water Table**	> 150 cm	> 75 - 150 cm	50 - 75 cm	< 50 cm

1 The symbol is used to indicate the property affecting use.
2 The first, three properties pertain to soil after it is placed in a fill; the last six properties pertain to soil in its natural condition before excavation for road fill.
3 This property estimates the strength of the soil material, that is, its ability to withstand applied loads.
4 Use AASHO group index only where laboratory data are available for the kind of soil being rated; otherwise, use Unified Soil Groups.
5 Downgrade suitability rating to fair if content of fines is more than about 30%.
6 P.I. means plasticity index.
7 Upgrade suitability rating to fair if MH is largely kaolinitic, friable, and free of mica.
8 Use this property only where frost penetrates below the paved or hardened surface layer and where moisture transportable by capillary movement is sufficient to form ice lenses at the freezing front.
9 For an explanation of stoniness, rockiness and soil drainage classes, see the Manual for Describing Soils in the Field (Soil and Landscape Management Section, Manitoba Agriculture, Food and Rural Initiatives and Land Resource Unit, Agriculture and Agri-Food Canada, 2007).

Table A12. Guide for Assessing Soil Suitability for Permanent Buildings[1]

This guide applies to undisturbed soils to be evaluated for single-family dwellings and other structures with similar foundation requirements. The emphasis for rating soils for buildings is on foundation requirements. However, soil slope, susceptibility to flooding and other hydrologic conditions, such as wetness, that have effects beyond those related exclusively to foundations, are considered as well. Also considered are soil properties, particularly depth to bedrock, which influence excavation, landscaping and septic tank absorption fields.

Symbol[2]	Property Affecting Use	Degree of Soil Suitability[3]			
		Good - G	Fair - F	Poor - P	Very Poor - V
w	**Wetness[4]**	With Basements: Very rapidly, rapidly and well drained Without Basements: Very rapidly, rapidly well and moderately well drained	With Basements: Moderately well drained Without Basements: Imperfectly drained	With Basements: Imperfectly drained Without Basements: Poorly drained	With Basements: Poorly, and very poorly drained Permanently wet soils Without Basements: Very poorly drained Permanently wet soils.
h	**Depth to Seasonal Water Table**	With Basements: > 150 cm Without Basements: > 75 cm	With Basements: > 75 - 150 cm Without Basements: > 50 - 75 cm	With Basements: 25 - 75 cm Without Basements: 25 - 50 cm	With Basements: < 25 cm Without Basements: < 25 cm
i	**Flooding**	None	None	Occasional flooding or ponding (once in 5 years)	Frequent flooding or ponding (every year)
t	**Slope[5]**	≤ 9% (a, b, c, d)	> 9 - 15% (e)	> 15 - 30% (f)	> 30% (g, h, i)
a	**Subgrade[6]** **a.) AASHO Group Index[7]** **b.) Unified Soil Group**	< 5 GW, GP, SW, SP, GC, SM and SC	5 - 8 CL (with P.I.[8] < 15)and ML	> 8 CL (with P.I.[8] of 15 or more), CH and MH	 OH, OL and PT
f	**Potential Frost Action[9, 13]**	Low (F1, F2)	Moderate (F3)	High (F4)	
p	**Stoniness[4]**	Stones > 10 m apart (Class 0 to 1)	Stones > 2 - 10 m apart (Class 2[10])	Stones 0.1 - 2 m apart (Class 3[10] to 4)	Stones < 0.1 m apart (Class 5[10])
r	**Rockiness[4,11]**	Rock exposure > 100 m apart and cover < 2% of the surface	Rock exposure 30 - 100 m apart and cover 2 - 10% of the surface	Rock exposure < 30 m apart and cover > 10% of the surface	Rock exposure too frequent to allow location of permanent buildings
d	**Depth to Bedrock[11]**	With Basements: > 150 cm Without Basements: > 100 cm	With Basements: > 100 - 150 cm Without Basements: 50 - 100 cm	With Basements: 50 - 100 cm Without Basements: < 50 cm	With Basements: < 50 cm

1 By halving the slope limits, this table can be used for evaluating soil suitability for buildings with large floor areas, but with foundation requirements not exceeding those of ordinary three-storey dwellings.

2 The symbol is used to indicate the property affecting use.

3 Some soils are assessed as fair or poor sites from an aesthetic or use standpoint, but they will require more site preparation and/or maintenance.

4 For an explanation of rockiness, stoniness and soil drainage classes, see the Manual for Describing Soils in the Field (Soil and Landscape Management Section, Manitoba Agriculture, Food and Rural Initiatives and Land Resource Unit, Agriculture and Agri-Food Canada, 2007).

5 Reduce the slope limits by one half for those soils subject to hillside slippage.

6 This property estimates the strength of the soil, that is, its ability to withstand applied loads. When available, AASHO Group Index values from laboratory tests were used; otherwise the estimated Unified Soil Groups were used.

7 Group Index values were estimated from information published by the Portland Cement Association (PCA, 1962), pp. 23 - 25.

8 P.I. means plasticity index.

9 Frost heave only applies where frost penetrates to the assumed depth of the footings and the soil is moist. The potential frost action classes are taken from the United States Army Corps of Engineers (1962), pp. 5 - 8. Use **z** for permanently frozen soils.

10 Rate one class better for building without basements.

11 Rate one class better if the bedrock is soft enough so that it can be dug with light power equipment such as backhoes.

Table A13. Guide for Assessing Soil Suitability for Local Roads and Streets[1]

This guide applies to soils to be evaluated for construction and maintenance of local roads and streets. These are improved roads and streets, having some kind of all-weather surfacing, commonly asphalt or concrete, and that are expected to carry automobile traffic all year. They consist of: (1) the underlying local soil material (either cut or fill) called the subgrade; (2) the base material of gravel, crushed rock, lime or soil cement, stabilized soil called the subbase; and (3) the actual road surface or pavement, either flexible or rigid. They are also graded to shed water and have ordinary provisions for drainage. With the probable exception of the hardened surface layer, the roads and streets are built mainly from the soil at hand, and cuts and fills are limited, usually less than two metres. Excluded from consideration in this guide are highways designed for fast moving, heavy trucks.

Properties that affect design and construction of roads and streets are: (1) those that affect the load supporting capacity and stability of the subgrade, and (2) those that affect the workability and amount of cut and fill. The AASHO and Unified Classification give an indication of the traffic supporting capacity. Wetness and flooding affect stability. Slope, depth of bedrock, stoniness, rockiness, and wetness affect the ease of excavation, and the amount of cut and fill to reach an even grade.

Symbol[2]	Property Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
w	**Wetness[3]**	Very rapidly, rapidly, well and moderately well drained	Imperfectly drained	Poorly and very poorly drained	Permanently wet soils
i	**Flooding**	None	Infrequent (once in 5 years)	Occasional (once in 2 - 4 years)	Frequent (every year)
t	**Slope**	≤ 9% (a, b, c, d)	> 9 - 15% (e)	> 15 - 30% (f)	> 30% (g, h, i)
d	**Depth to Bedrock[4]**	> 100 cm	50 - 100 cm	< 50 cm	
a	**Subgrade[5]** **a.) AASHO Group Index[6]**	< 5	5 – 8	> 8	
	b.) Unified Soil Group	GW, GP, GC[7], SW, SP, SM, and SC[7]	CL (with P.I.[8] < 15) and ML	CL (with P.I.[8] of 15 or more), CH and MH	OH, OL and PT and loose sand with high organic matter
f	**Susceptibility to Frost Heave[9]**	Low (F1, F2)	Moderate (F3)	High (F4)	
p	**Stoniness[3]**	Stones > 2 m apart (Class 0 to 2)	Stones > 0.5 - 2 m apart (Class 3)	Stones 0.1 - 0.5 m apart (Class 4)	Stones < 0.1 m apart (Class 5)
r	**Rockiness[3]**	Rock exposures > 100 m apart and cover < 2% of the surface	Rock exposures 30 -100 m apart and cover 2 - 10% of the surface	Rock exposures < 30 m apart and cover >10% of the surface	Rock exposures too frequent to permit location of roads and streets

1 These guidelines, with some adjustment of slope and rockiness limits, will also be useful for assessing soils for use as parking lots.
2 The symbol is used to indicate the property affecting use.
3 For an explanation of stoniness, rockiness and soil drainage classes, see the Manual for Describing Soils in the Field (Soil and Landscape Management Section, Manitoba Agriculture, Food and Rural Initiatives and Land Resource Unit, Agriculture and Agri-Food Canada, 2007).
4 Rate one class better if the bedrock is soft enough so that it can be dug with light power equipment and is rippable by machinery.
5 This property estimates the strength of soil materials as it applies to roadbeds. When available, AASHO Group Index values from laboratory tests were used; otherwise, the estimated Unified Soil Groups were used. The limitations were estimated assuming that the roads would be surfaced. On unsurfaced roads, rapidly drained, very sandy, poorly graded soils may cause washboard or rough roads.
6 Group index values were estimated from information published by the Portland Cement Association (PCA, 1962) pp. 23 - 25.
7 Downgrade to moderate if content of fines (less than 200 mesh) is greater than about 30%.
8 P.I. means plasticity index.
9 Frost heave is important where frost penetrates below the paved or hardened surface and moisture movement by capillary action sufficient to form ice lenses at the freezing point. The susceptibility classes are taken from the United States Army Corps of Engineers (1962) pp. 5 - 8.

Table A14. Guide for Assessing Soil Suitability for Trench-type Sanitary Landfills[1]

The trench-type sanitary landfill, involves the daily burial of dry garbage and trash in an open trench that is covered with a layer of soil material. Suitability of the site is dependent upon the potential for pollution of water sources through groundwater contact with the refuse, or leachate arising from the site. Those properties affecting ease of excavation of the site must be supplemented with geological and hydrological knowledge to provide subsurface soil and groundwater data to a depth of at least three to 4.5 m, a common depth of landfills.

Symbol[2]	Property Affecting Use	Degree of Soil Suitability			
		Good - G[3]	Fair - F	Poor - P	Very Poor - V
h	**Depth to Seasonal High Water Table**	Not class determining if deeper than 180 cm		100 - 180 cm	< 100 cm
w	**Wetness[4]**	Not class determining if better than imperfectly drained		Imperfectly drained	Poorly and very poorly drained or permanently wet soils
i	**Flooding**	None	Rare	Occasional (Once in 2 - 4 years)	Frequent (Every year)
k	**Permeability[4,5,8]**	< 5 cm/hr	< 5 cm/hr	5 - 15 cm/hr	> 15 cm/hr
t	**Slope**	≤ 15% (a, b, c, d, e)	> 15 - 30% (f)	> 30 - 45% (g)	> 45% (h, i)
s	**Soil Texture[4,6] (dominant to a depth of 150 cm)**	Si, SiL, L, SCL, VFSL, SL, LVFS, LFS, VFS	SiCL[7], CL, SC, LS	SiC, C	Muck, peat, sand (CoS, MS, FS) and gravel
d	**Depth to Hard Bedrock**	> 150 cm	> 150 cm	100 - 150 cm	< 100 cm
	Rippable Bedrock	> 150 cm	100 - 150 cm	100 - 150 cm	< 100 cm
p	**Stoniness[4]**	Stones > 10 m apart (Class 0 and 1)	Stones > 2 - 10 m apart (Class 2)	Stones 0.1 - 2 m apart (Class 3 and 4)	Stones < 0.1 m apart (Class 5)
r	**Nature of Bedrock**	Impermeable			Highly permeable, fractured, easily soluble.

1 Based on soil depth (120 cm) commonly investigated in making soil surveys.
2 The symbol is used to indicate the property affecting use.
3 If probability is high that the soil material to a depth of three to 4.5 m will not alter a rating of good or fair, indicate this by an appropriate footnote, such as "Probably good to a depth of 3.5 m," or "Probably fair to a depth of 3.5 m."
4 For an explanation of stoniness, texture and soil drainage classes, see the Manual for Describing Soils in the Field (Soil and Landscape Management Section, Manitoba Agriculture, Food and Rural Initiatives and Land Resource Unit, Agriculture and Agri-Food Canada, 2007).
5 Reflects ability of soil to retard movement of leachate from the landfills; may not reflect a limitation in arid and semiarid areas.
6 Reflects ease of digging, moving (workability) and trafficability in the immediate area of the trench where there may not be surfaced roads.
7 Soil high in expansive clays may need to be given a suitability rating of poor.
8 Contamination hazard (**g**) may apply at high permeability.

Table A15. Guide for Assessing Soil Suitability for Area-type Sanitary Landfills

In the area-type sanitary landfill, refuse is placed on the surface of the soil in successive layers. The daily and final cover material is generally imported. A final cover of soil material at least 60 cm thick is placed over the fill when it is completed.

The soil under the proposed site should be investigated to determine the probability that leachates from the landfill may penetrate the soil, and thereby, pollute water supplies.

Symbol[1]	Property Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
h	**Depth to Seasonal Water Table[2]**	> 150 cm	> 100 - 150 cm	50 - 100 cm	< 50 cm
w	**Wetness[2,3]**	Rapid to moderately well drained	Imperfectly drained	Poorly drained	Very poorly drained or permanently wet soils
i	**Flooding**	None	Rare	Occasional (Once in 2 - 4 years)	Frequent (Every year)
k	**Permeability[4,5,6]**	Not class determining if less than 5 cm/hr		5 - 15 cm/hr	> 15 cm/hr
t	**Slope**	≤ 9% (a, b, c, d)	> 9 - 15% (e)	> 15 - 30% (f)	> 30% (g, h, i)

1 The symbol is used to indicate the property affecting use.
2 Reflects influence of wetness on operation of equipment.
3 For an explanation of drainage, see the Manual for Describing Soils in the Field (Soil and Landscape Management Section, Manitoba Agriculture, Food and Rural Initiatives and Land Resource Unit, Agriculture and Agri-Food Canada, 2007).
4 Reflects ability of the soil to retard movement of leachate from landfills; may not reflect a limitation in arid and semiarid areas.
5 Due to possible groundwater contamination, impermeable bedrock is considered poor and permeable bedrock is rated very poor.
6 Contamination hazard (**g**) may apply at high permeability and/or proximity of the site to water supplies.

Table A16. Guide for Assessing Soil Suitability as Cover Material for Area-type Sanitary Landfills

The term cover material includes soil materials used to put a daily and final covering layer in area-type sanitary landfills. This cover material may be derived from the area of the landfill or may be brought in from surrounding areas.

Symbol[1]	Property Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
u	**Moist Consistence[2]**	Very friable, friable	Loose, firm	Very firm	Cemented
s	**Texture[2,3]**	Si, SiL, SCL, L, VFSL, FSL, LVFS, VFS	SiCL, CL, SC, LFS, LS	SiC, C	Muck, peat, sand, gravel
d	**Depth to bedrock[4]**	> 150 cm	> 100 - 150 cm	50 - 100 cm	< 50 cm
c	**Coarse fragments[2] (% by volume)**	≤ 15%	> 15 - 35%	> 35%	
p	**Stoniness[2]**	Stones > 10 m apart (Class 0 and 1)	Stones > 2 - 10 m apart (Class 2)	Stones 0.1 - 2 m apart (Class 3 and 4)	Stones < 0.1 m apart (Class 5)
t	**Slope**	≤ 9% (a, b, c, d)	> 9 - 15% (e)	> 15 - 30% (f)	> 30% (g, h, i)
w	**Wetness[2]**	Not class determining if better than poorly drained.		Poorly drained	Very poorly drained or permanently wet soils.
q	**Depth to Sand and Gravel**	> 1.5 m	1 - 1.5 m	< 1 m	

1 The symbol is used to indicate the property affecting use.
2 For an explanation of consistence, texture, coarse fragments, stoniness and soil drainage classes, see the Manual for Describing Soils in the Field (Soil and Landscape Management Section, Manitoba Agriculture, Food and Rural Initiatives and Land Resource Unit, Agriculture and Agri-Food Canada, 2007).
3 Soils having a high proportion of non-expansive clays may be given a suitability rating one class better than is shown for them in this table.
4 Thickness of material, excluding topsoil, which will be stockpiled (see guide for topsoil).

Table A17. Guide for Assessing Soil Suitability for Reservoirs and Sewage Lagoons

Factors affecting the ability of undisturbed soils to impound water or sewage and prevent seepage, are considered for evaluating the suitability of soils for reservoir and lagoon areas. This evaluation considers soil both as a vessel for the impounded area and as material for the enclosing embankment. As the impounded liquids could be **potential sources of contamination of nearby water supplies** (e.g. sewage lagoons), the landscape position of the reservoir as it affects risk of flooding must also be considered.

Symbol[1]	Property Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
h	**Depth to Water Table[2]**	> 150 cm	> 100 - 150 cm	50 - 100 cm	< 50 cm
i	**Flooding[3]**	None	None	Subject to infrequent flooding (once in 50 years)	Subject to frequent high level flooding
k	**Soil Permeability[4]**	< 0.05 cm/hr	0.05 - 0.5 cm/hr	> 0.5 - 5 cm/hr	> 5 cm/hr
t	**Slope**	≤ 2% (a, b)	> 2 - 5% (c)	> 5 - 9% (d)	> 9% (e, f, g, h, i)
o	**Organic Matter**	≤ 2 %	> 2 - 10%	> 10 - 30%	> 30%
c	**Coarse Fragments[5] < 25 cm in diameter, (% by volume)**	≤ 20%	> 20 - 35%	> 35%	
p	**Stoniness[5], >25 cm diameter, (% of surface area)**	≤ 3% (Class 0, 1 and 2)	> 3 - 15% (Class 3)	> 15 - 50% (Class 4)	> 50% (Class 5)
d	**Depth to Bedrock[6]**	> 150 cm	> 100 - 150 cm	50 - 100 cm	< 50 cm
j	**Thickness of Slowly Permeable Layer**	> 100 cm	> 50 - 100 cm	50 - 25 cm	< 25 cm
a	**Sub-grade Unified Soil Group**	CH	GC, SC and CL	GM, SM, ML & MH	GW, GP, SW & SP, OL, OH & PT

1 The symbol is used to indicate the property affecting use.
2 If the floor of the lagoon has nearly impermeable material at least 50 cm thick, disregard depth to water table.
3 Disregard flooding if it is not likely to enter or damage the lagoon (flood waters have low velocity and depth less than 150 cm).
4 Contamination hazard (**g**) may apply at high permeability and/or proximity of the site to water supplies.
5 For an explanation of coarse fragments and stoniness classes, see the Manual for Describing Soils in the Field (Soil and Landscape Management Section, Manitoba Agriculture, Food and Rural Initiatives and Land Resource Unit, Agriculture and Agri-Food Canada, 2007).
6 Surface exposures of non rippable rock are rated poor. If underlying bedrock is impermeable, rating should be one class better.
7 Material must be capable of compaction to 10^{-7} m/sec (0.04 cm/hr) for use as liner or embankment.

Table A18. Guide for Assessing Soil Suitability for Septic Tank Absorption Fields

This guide applies to soils to be used as an absorption and filtering medium for effluent from septic tank systems. A subsurface tile system laid in such a way that effluent from the septic tank is distributed reasonably and uniformly into the natural soil is assumed when applying this guide. A rating of poor need not mean that a septic system should not be installed in the given soil, but rather, may suggest the difficulty, in terms of installation and maintenance, that can be expected.

Symbol[1]	Property Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
k	**Permeability**[2,7]	Rapid to moderately rapid	Moderate	Slow	Very Slow
	Percolation Rate[3] **(Auger hole method)**	≤ 8 - 18 min/cm (> 3.3 - 7.5 cm/hr)	> 18 - 24 min/cm (2.5 - 3.3 cm/hr)	> 24 min/cm (< 2.5 cm/hr)	
h	**Depth to Seasonal Water Table**[4]	> 150 cm [5]	> 100 - 150 cm	50 - 100 cm	< 50 cm
i	**Flooding**	Not subject to flooding	Not subject to flooding	Subject to occasional flooding (once in 5 years)	Floods every year
t	**Slope**	≤ 9% (a, b, c, d)	> 9 - 15% (e)	> 15 - 30% (f)	> 30% (g, h, i)
d	**Depth to Hard Rock, bedrock or other impervious materials**	> 150 cm	> 100 - 150 cm[6]	50 - 100 cm	< 50 cm

1 The symbol is used to indicate the property affecting use.
2 The suitability ratings should be related to the permeability of soil layers at and below depth of the graded filter bed (50 to 75 cm depth).
3 Soils having a percolating rate less than about 8 min/cm are likely to present a pollution hazard to adjacent waters. This hazard must be noted, but the degree of hazard must, in each case, be assessed by examining the proximity of the proposed installation to water bodies, water table and related features**. The symbol g is used to indicate this condition.** Refer to U.S. Dept. of Health, Education and Welfare (1969) for details of this procedure.
4 Seasonal means for more than one month. It may, with caution, be possible to make some adjustment for the severity of a water table limitation in those cases where seasonal use of the facility does not coincide with the period of high water table.
5 A seasonal water table should be at least 100 cm below the bottom of the trench at all times for soils rated Good (U.S. Dept. of Health, Education and Welfare, 1969). The depths used to water table are based on an assumed tile depth of 50 cm. Where relief permits, the effective depth above a water table or rock can be increased by adding appropriate amounts of fill.
6 Where the slope is greater than nine per cent, a depth to bedrock of 100 to 150 cm is assessed as Poor.
7 Contamination hazard (**g**) may apply at high permeability (e.g. (Gg)).

Table A19. Guide for Assessing Soil Suitability for Playgrounds

This guide applies to soils to be used intensively for playgrounds, football, badminton, and other similar activities. These areas are subject to intensive foot traffic. A nearly level surface, good drainage, and a soil texture and consistence that provide a firm surface generally are required. The most desirable soils are free of rock outcrops and coarse fragments.
Soil suitability for growing and maintaining vegetation is not a part of this guide, except as influenced by moisture. However, it is an important consideration in the final evaluation of site.

Symbol[1]	Property Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
w	**Wetness[2]**	Rapidly, well and moderately well drained soils with no ponding or seepage. Water table below 75 cm during season of use.	Moderately well drained soils subject to occasional ponding or seepage for short duration and imperfectly drained soils. Water table below 50 cm during season use.	Imperfectly drained soils subject to ponding or seepage, and poorly drained soils. Water table above 50 cm during season of use.	Very poorly drained and permanently wet soils.
i	**Flooding**	None during season of use.	Occasional flooding. May flood once every 2 - 3 years during season of use.	Floods every year during season of use.	Prolonged flooding during season of use.
k	**Permeability**	Very rapid to moderate	Moderately slow and slow	Very slow	
t	**Slope**	≤ 2% (a, b)	> 2 - 5% (c)	> 5 - 9% (d)	> 9% (e, f, g, h, i)
d	**Depth to Bedrock**	> 100 cm	50 - 100 cm[3]	< 50 cm[3]	
c	**Coarse fragments on surface[2]**	Relatively free of coarse fragments	≤ 20% coarse fragments	> 20% coarse fragments	
p	**Stoniness[2]**	Stones > 10 m apart (Class 0 to 1)	Stones > 2 - 10 m apart (Class 2)	Stones 0.1 - 2 m apart (Class 3, 4)	Stones < 0.1 m apart (Class 5)
r	**Rockiness[2]**	Rock exposures > 100 m apart and cover < 2% of the surface	Rock exposures 30 - 100 m apart and cover about 2 - 10% of the surface	Rock exposures < 30 m apart and cover > 10% of the surface	Rock outcrops too frequent to permit playground location
s	**Surface Soil Texture[2,4]**	L, VFSL, FSL, SL, LVFS, VFS	SiL, CL, SiCL, SCL, LFS, LS, FS	SiC, C, SC[5], Si, S	Peaty soils; S and LS subject to blowing
q	**Depth to Sand or Gravel[6]**	> 100 cm	50 - 100 cm	< 50 cm	
m	**Useful Moisture[7]**	Water storage capacity[8] >15.0 cm and/or adequate rainfall and/or low evapotranspiration	Water storage capacity[8] 7.5 - 15 cm and/or moderate rainfall and/or moderate evapotranspiration	Water storage capacity[8] < 7.5 cm and/or low rainfall and/or high evapotranspiration	
n	**Salinity[9]**	EC < 4 mS/cm	EC 4 - 8 mS/cm (s)	EC > 8 - 16 mS/cm (t)	EC > 16 mS/cm (u)

1 The symbol is used to indicate the property affecting use.
2 See also definitions for coarse fragments, rockiness, stoniness, textural and soil drainage classes in the Manual for Describing Soils in the Field (Soil and Landscape Management Section, Manitoba Agriculture, Food and Rural Initiatives and Land Resource Unit, Agriculture and Agri-Food Canada 2007).
3 Downgrade to a very poor suitability rating if the slope is greater than five per cent.
4 Surface soil texture influences soil ratings as it affects foot trafficability, surface wetness, dust and maintenance. Adverse soil textures may be partially or completely overcome with the addition of topsoil.
5 Moderately well and well drained SiC, C and SC soils may be rated fair.
6 Depth to sand or gravel is considered a limitation if the levelling operations expose sand or gravel, thereby bringing about adverse surface textures and undesirable amounts of coarse fragments. The addition of topsoil after the levelling process would overcome this limitation.
7 This property attempts to evaluate the adequacy of moisture for vegetative growth. It incorporates the concept of supply through rainfall, loss through evapotranspiration, and storage within the rooting zone. In soils where the water table is within rooting depth for a significant portion of the year, water storage capacity may not significantly influence vegetation growth.
8 Consult glossary for definitions of terms used.
9 EC = Electrical conductivity (milliSiemens/cm, mS/cm or deciSiemens/m, or dS/m).

Table A20. Guide for Assessing Soil Suitability for Picnic Areas

This guide applies to soils considered for intensive use as park-type picnic areas. It is assumed that most vehicular traffic will be confined to the access roads. Soil suitability for growing and maintaining vegetation is not a part of this guide, except as influenced by moisture. However, it is an important consideration in the final evaluation of site.

Symbol[1]	Property affecting use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
w	**Wetness**[2]	Very rapidly, rapidly, well and moderately well drained soils, not subject to seepage or ponding. Water table below 50 cm during season of use.	Moderately well drained soils, subject to occasional seepage or ponding and imperfectly drained soils not subject to seepage or ponding. Water Table above 50 cm for short periods during season of use	Imperfectly drained soils subject to seepage or ponding. Poorly drained soil. Water table above 50 cm and often near surface for a month or more during season of use.	Very poorly drained and permanently wet soils.
i	**Flooding**	None during season of use.	May flood 1 or 2 times per year for short periods during season of use.	Floods more than 2 times during season of use.	Prolonged flooding during season of use.
t	**Slope**	≤ 9% (a, b, c, d)	> 9 - 15% (e)	> 15 - 30% (f)	> 30% (g, h, i)
s	**Surface Soil Texture**[2,3]	L, VFSL, FSL, SL, LVFS, VFS	SiL, CL, SiCL, SCL, LFS, LS, FS and sand other than loose sand.	SiC, C, SC[4], Si	Peaty soils; loose sand subject to blowing.
c	**Coarse Fragments on Surface**[2]	< 20%	20 - 50%	> 50%	
p	**Stoniness**[2]	Stones > 2 m apart (Class 0 to 2)	Stones > 1 - 2 m apart (Class 3)	Stones 0.1 - 1 m apart (Class 4)	Stones < 0.1 m apart (Class 5)
r	**Rockiness**[2,5,6]	Rock exposure roughly > 30 - 100 m or more apart and cover < 10% of the surface.	Rock exposure roughly 10 - 30 m apart and cover 10 - 25 % of the surface.	Rock exposure < 10 m apart and cover > 25% of the surface.	Rock exposure too frequent to permit location of picnic areas.
m	**Useful Moisture**[7]	Water storage capacity[8] > 15 cm and/or adequate rainfall and/or low evapotranspiration.	Water storage capacity[8] 7.5 - 15 cm and/or moderate rainfall and/or moderate evapotranspiration.	Water storage capacity[8] < 7.5 cm and/or low rainfall and/or high evapotranspiration.	
n	**Salinity**[9]	EC < 4 mS/cm	EC 4 - 8 mS/cm (s)	EC > 8 - 16 mS/cm (t)	EC > 16 mS/cm (u)

1 The symbol is used to indicate the property affecting use.

2 See also definitions for coarse fragments, rockiness, stoniness, textural and soil drainage classes in the Manual for Describing Soils in the Field (Soil and Landscape Management Section, Manitoba Agriculture, Food and Rural Initiatives and Land Resource Unit, Agriculture and Agri-Food Canada 2007). Coarse fragments for the purpose of this rating include gravel and cobbles. Some gravelly soils may be rated as having a slight limitation if the content of gravel exceeds 20% by only a small margin, providing (a) the gravel is embedded in the soil matrix, or (b) the fragments are less than two cm in size.

3 Surface soil texture influences soil ratings as it affects foot trafficability, dust and soil permeability.

4 Moderately well and well drained SiC, C and SC soils may be rated fair.

5 Very shallow soils are rated as having severe or very severe limitations for stoniness or rockiness.

6 The nature and topography of the bedrock exposures may significantly alter these ratings. As such, on-site investigations will be necessary in map units containing bedrock, when these are considered as possible sites.

7 This property attempts to evaluate the adequacy of moisture for vegetative growth. It incorporates the concept of supply through rainfall, loss through evapotranspiration, and storage within the rooting zone. In soils where the water table is within rooting depth for a significant portion of the year, water storage capacity may not significantly influence vegetation growth.

8 Consult glossary for definitions of terms used.

9 EC = Electrical conductivity (milliSiemens/cm, mS/cm or deciSiemens/m, or dS/m).

Table A21. Guide for Assessing Soil Suitability for Camp Areas

This guide applies to soils to be used intensively for tents and camp trailers, and the accompanying activities of outdoor living. It is assumed that little site preparation will be done, other than shaping and levelling for campsites and parking areas. The soil should be suitable for heavy foot traffic by humans, as well as limited vehicular traffic. Soil suitability for growing and maintaining vegetation is not a part of this guide. However, it is an important consideration in the final evaluation of site.

Back country campsites differ in design, setting and management, but require similar soil attributes. These guides should apply to evaluations for back country campsites, but depending on the nature of the facility, the interpreter may wish to adjust the criteria, defining a given degree of limitation to reflect the changed requirement. For example, small tent sites may allow rock exposures greater than 10 m apart to be considered slight limitations.

Symbol[1]	Property Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
w	**Wetness[2]**	Very rapidly, rapidly, well and moderately well drained soils, with no seepage or ponding. Water table below 75 cm during season of use.	Moderately well drained soils, subject to occasional seepage or ponding and imperfectly drained soils with no seepage or ponding. Water table below 50 cm during season of use	Imperfectly drained soils subject to seepage or ponding and poorly drained soils. Water table above 50 cm during season of use.	Very poorly drained and permanently wet soils.
l	**Flooding**	None	Very occasional flooding during season of use. (Once in 5 - 10 years)	Occasional flooding during season of use. (Once in 2 - 4 years)	Flooding during every season of use.
k	**Permeability**	Very rapid to moderate	Moderately slow and slow	Very slow	
t	**Slope**	≤ 9% (a, b, c, d)	> 9 - 15% (e)	> 15 - 30% (f)	> 30% (g, h, i)
s	**Surface Soil Texture[2,3]**	L, VFSL, FSL, SL, LVFS, VFS	SiL, CL, SiCL, SCL, LFS, LS, FS and sand other than loose sand.	SiC, C, SC[4], Si	Peaty soils: loose sand subject to blowing.
c	**Coarse Fragments on Surface[2,5]**	< 20%	20 - 50%	> 50%	
p	**Stoniness[2,6]**	Stones > 10 m apart (Class 0 and 1)	Stones > 2 - 10 m apart (Class 2)	Stones 0.1 - 2 m apart (Class 3 and 4)	Stones < 0.1 m apart (Class 5)
r	**Rockiness[2,6]**	No rock exposures	Rock exposures 10 m apart and cover 25% or less of the area.	Rock exposures < 10 m apart and cover > 25% of the area.	Rock exposures too frequent to permit campground location.
n	**Salinity[7]**	EC < 4 mS/cm	EC 4 - 8 mS/cm (s)	EC > 8 - 16 mS/cm (t)	EC > 16 mS/cm (u)

1 The symbol is used to indicate the property affecting use.
2 See also definitions for coarse fragments, rockiness, stoniness, textural and soil drainage classes in the Manual for Describing Soils in the Field (Soil and Landscape Management Section, Manitoba Agriculture, Food and Rural Initiatives and Land Resource Unit, Agriculture and Agri-Food Canada, 2007).
3 Surface soil texture influences soil rating as it affects foot trafficability, dust and soil permeability.
4 Moderately well and well drained SiC, C and SC soils may be rated fair.
5 Coarse fragments for the purpose of this table include gravels and cobbles. Some gravelly soils may be rated as having slight limitations if the content of gravel exceeds 20% by only a small margin, providing (a) the gravel is embedded in the soil matrix, or (b) the fragments are less than 2 cm in size.
6 Very shallow soils are rated as having a limitation for rockiness and/or stoniness.
7 EC = Electrical conductivity (milliSiemens/cm, mS/cm or deciSiemens/m, or dS/m).

Table A22. Guide for Assessing Soil Suitability for Paths and Trails

It is assumed that the trails will be built at least 45 cm wide and that obstructions, such as cobbles and stones, will be removed during construction. It is also assumed that a dry, stable tread is desirable and that muddy, dusty, worn or eroded trail treads are undesirable. Hiking and riding trails are not treated separately, but as the design requirements for riding trails are more stringent, a given limitation will be more difficult to overcome. Poor or very poor suitability does not indicate that a trail cannot or should not be built. It does, however, suggest higher design requirements and maintenance to overcome the limitations.

Symbol[1]	Property Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
s	**Texture**[3,4]	L, VFSL, FSL, SL, LVFS, LFS, LS, VFS	CL, SiCL, SiL, SCL	SiC, C, SC[5], Si, FS, S	Peaty soils; loose sand subject to blowing
c	**Coarse Fragment Content**[4,6]	< 20%	20 - 50%	> 50%	
p	**Stoniness**[4]	Stones > 2 m apart (Class 0 to 2)	Stones > 1 - 2 m apart (Class 3)	Stones 0.1 - 1 m apart (Class 4)	Stones < 0.1 m apart (Class 5)
w	**Wetness**[4]	Very rapidly, rapidly well, and moderately well drained soils. Water table below 50 cm during season of use.	Moderately well drained soils, subject to occasional seepage and ponding and imperfectly drained soils. Water table may be above 50 cm for short periods during season of use.	Poorly and very poorly drained soils. Water table above 50 cm and often near surface for a month or more during season of use.	Permanently wet soils.
r	**Rockiness**[4,7]	Rock exposures > 30 m apart and cover < 10% of the surface.	Rock exposures 10 - 30 m apart and cover 10 - 25% of the surface.	Rock exposures < 10 m apart and cover > 25% of the surface.	Rock exposures too frequent to permit location of paths and trials.
t	**Slope**[8]	≤ 15% (a, b, c, d, e)	> 15 - 30% (f)	> 30 - 45% (g)	> 45% (h, i)
i	**Flooding**	Not subject to flooding during season of use.	Floods 1 or 2 times during season of use.	Floods more than 2 times during season of use.	Subject to prolonged flooding during season of use.

1 The symbol is used to indicate the property affecting use.

2 The properties affecting use listed in this table are those which have been shown to cause significant differences in trail response. Elevation, aspect, position on slope, and snow avalanching may have slight affects or influence trail management and should be considered in the final site evaluation. Items such as vegetation, fauna and scenic value are not considered in the guidelines.

3 Texture refers to the soil texture, which will form the tread texture. This is the surface texture on level areas, but may be a subsurface texture on slopes. Textural classes are based on the less than two mm soil fraction. Texture influences soil ratings as it influences foot trafficability, dust, design or maintenance of trails, and erosion hazards.

4 See also definitions for coarse fragments, rockiness, stoniness, textural and soil drainage classes in the Manual for Describing Soils in the Field (Soil and Landscape Management Section, Manitoba Agriculture, Food and Rural Initiatives and Land Resource Unit, Agriculture and Agri-Food Canada, 2007).

5 Moderately well and well drained SiC, C and SC soils may be rated fair.

6 Coarse fragments for the purpose of this table, include gravels and cobbles. Gravels tend to cause unstable footing when present in high amounts, and are also associated with increased erosion. Cobbles (and stones) must be removed from the trail tread, increasing construction and maintenance difficulties. Some gravelly soils may be rated as having a slight limitation if the content of gravel exceeds 20% by only a small margin, providing (a) the gravel is embedded in the soil matrix or (b) the fragments are less than two cm in size.

7 The type of rock outcrop (flat lying vs cliffs), and the orientation of the structure (linear cliffs vs massive blocks) can greatly alter the degree of the limitation. Each site with a Rockiness limitation based on the per cent rock outcrop above should be evaluated on its own merits and the degree of limitation should then be modified appropriately, if necessary.

8 Slope in this context refers to the slope of the ground surface, not the slope of the tread.

Appendix 2 Soil Series Descriptions

Angusville Series (ANL)

Angusville series is characterized by a Gleyed Eluviated Black Chernozem soil profile, developed on moderately to strongly calcareous, slightly stony, fine loamy (L, CL) morainal till of limestone, granitic and shale bedrock origin. These soils are imperfectly drained and occur in lower to mid-slope positions of undulating to hummocky landscapes, in close association with the well drained Newdale, Rufford and Cordova soils, the imperfectly drained Varcoe series, and the poorly drained Drokan and Penrith series. Surface runoff is slow to moderately slow. Permeability is moderately slow to slow within the solum, and moderately slow in the subsoil. Vegetation on non-cultivated lands consists of trembling aspen.

The average thickness of the soil profile is 83 cm and varies from 45 to 100 cm. The A horizon has a thickness of 32 cm and ranges from 20 to 50 cm. The very dark gray to gray Ap horizon is 15 to 20 cm thick, and the dark gray to gray Ahe horizon, five to 30 cm thick. The dark brown to dark yellowish brown Btjgj or Btgj horizon is 25 to 35 cm thick. A carbonate enriched layer of 10 to 20 cm is usually present. The Ckg horizon is light olive brown, with yellowish brown mottles. The Angusville soil profile is more strongly developed, deeper and free of carbonate as compared to the closely associated, shallower, carbonated Gleyed Rego Black Chernozem, Varcoe series.

Arizona Series (AIZ)

The Arizona series consists of moderately well to well drained, Orthic Regosol soils, developed on weakly to moderately calcareous, sandy (FS, LS, LFS), lacustrine and deltaic deposits. These soils occur in upper slope and knoll positions of gentle slopes on hummocky landscapes, and have rapid permeability, low surface runoff, and a low water table during the growing season. Arizona soils are severely wind eroded, non-stony and non-saline. They have low available water-holding capacity, low organic matter content, and low natural fertility. Native vegetation includes scrub oak, black spruce and prairie grasses. The majority of these soils are currently wooded or used for natural grazing.

In a representative profile of Arizona soil, there is no solum. The profile is characterized by a gray to light gray Ah horizon, five to 15 cm thick, and a brown to very pale brown Ck horizon, with faint reddish brown mottles.

Arizona soils occur in close association with Cactus soils and are similar to Shilox soils by having a Regosolic profile in sand deposits. However, they differ from them by having deposits of lacustrine origin, while Shilox soils are eolian. Arizona soils were previously mapped as eroded phases of the Stockton Association in the Carberry (1957) soil report.

Ashmore Series (AHO)

The Ashmore series consists of moderately well to well drained, Rego Black Chernozem soils, developed on a thin mantle (25 to 50 cm) of moderately to strongly calcareous sediments of VFS, LVFS, FSL and SL texture, overlying moderately to strongly calcareous, medium sand to gravelly glaciofluvial deposits. These soils occur in irregularly sloping terrain, ranging from gently undulating to strongly rolling. They have moderately rapid permeability in the upper sediments and very rapid permeability in the gravelly deposits. Runoff is moderate to rapid, depending on the degree of slope. The stoniness varies from few stones to very stony land. The native vegetation consists of bur oak and aspen.

A very dark gray Ahk horizon 10 to 17 cm thick and a thin AC horizon characterize the soil. A lime accumulation layer (Cca) may be present. Cultivated soils on the gently undulating and undulating slopes may be slightly eroded.

Assiniboine Series (ASB)

The Assiniboine series consists of imperfectly drained Gleyed Cumulic Regosol soils, developed on moderately to strongly calcareous, stratified, clayey (SiC, C) alluvium deposits. These soils occur in lower slope positions of very gentle slopes on flood plain landscapes. They have moderately slow permeability, slow surface runoff, and a medium water table during the growing season. Assiniboine soils are slightly water-eroded, non-stony, and non-saline. They have high available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes ash, elm, tall prairie and meadow grasses. The majority of these soils are currently cultivated.

In a representative profile of Assiniboine soil, there is no solum. The profile is characterized by a dark gray to gray Ah horizon, five to 20 cm thick, and a dark gray Ckgj horizon, many prominent mottles. The parent material is typically stratified and may contain dark strata representing former surfaces.

Assiniboine soils have a profile similar to the Levine soils, but differ from them by having finer textured deposits. These soils were mapped as inclusions of the Assiniboine Complex in the Carberry (1957) soil report.

Bankton Series (BAO)

The Bankton Series consists of well to moderately well drained, Rego Black Chernozem soils, developed on moderately to strongly calcareous, silty clay to clay lacustrine deposits. They occur adjacent to the creeks in a level to very gently sloping topography. Permeability is slow and runoff is moderately slow. The natural vegetation consists of tall prairie grasses.

The soil is characterized by a very dark gray to black Ah horizon 16 to 22 cm thick and a calcareous, dark gray ACk horizon of irregular thickness (due to past cracking and in-filling), grading to the grayish brown C horizon. Some mottles and duller colours occur below the 75 cm depth.

Basker Series (BKR)

The Basker series consists of poorly to very poorly drained Rego Humic Gleysol soils, developed on moderately to strongly calcareous, stratified, loamy (FSL, VFSL, L, SiL, SiCL, CL), recent alluvial deposits. These soils occur in depressional positions of nearly level slopes on flood plain landscapes and have slow permeability, very slow surface runoff, and a high water table during the growing season. Basker soils are slightly water-eroded, non-stony, and occasionally slightly saline. They have a high available water-holding capacity, medium organic matter content, and low natural fertility. Native vegetation includes sedges, rushes and willows. The majority of these soils are currently in native vegetation because they are subject to flooding and saturated conditions in the spring.

In a representative profile of Basker soil, there is no soil solum. The profile is characterized by light grayish brown Ahk horizon, five to 20 cm thick, with iron stains and a stratified, olive brown Ckg horizon, with prominent iron mottles in the sandy strata. A typical profile also contains thin organic layers, indicating former surfaces.

Basker soils occur in close association with Levine soils. They are similar to Kerran soils by having a poorly drained profile developed in recent alluvium, but differ from them in having mostly loam rather than clay textures. Basker soils were previously mapped as Meadow associates of the Assiniboine Complex in the South-Central (1943) and Carberry (1957) reports.

Barwood Series (BWO)

The Barwood series consists of imperfectly drained Gleyed Rego Black Chernozem soils, developed on strongly to extremely calcareous (~40% $CaCO_3$), deep uniform, fine loamy (L, CL, SiCL), boulder till

of limestone and granitic origin. These soils occur in toe and lower slope positions of strong slopes on hummocky landscapes and have moderately slow permeability, moderately slow surface runoff, and a medium water table during the growing season. Barwood soils are non-eroded, slightly stony and occasionally slightly saline. They have medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation often includes tall prairie grasses. The majority of these soils are currently used for improved pasture and grain crop production.

In a representative profile of Barwood soil, the solum is approximately 20 cm thick. The profile is characterized by a very dark gray to black Ap or Ah horizon, 10 to 15 cm thick, a thin transitional, calcareous AC horizon, 15 to 20 cm thick, and a very pale brown, extremely calcareous, Ck horizon, with iron stains. A typical profile also contains lime and manganese concretions at depth.

Barwood soils occur in close association with Hilton and Tiger Hills soils. They are similar to Ferris soils by having a Gleyed Rego Black profile developed in calcareous till, but differ from Ferris soils because of the extreme calcareous nature of Hilton till material and its relatively shallow profile. Barwood soils were previously mapped as imperfectly drained inclusions of the Hilton Association in the reconnaissance soil survey of South-Central Manitoba (1943).

Beresford Series (BSF)

The Beresford series consists of imperfectly drained Gleyed Rego Black Chernozem soils, developed on a thin mantle (<1 m) of loamy (L, SiL, CL, SiCL) lacustrine sediments, over strongly to very strongly calcareous, loam to clay loam glacial till of shale, limestone and granitic origin. These soils occur on near level to undulating topographic landscapes, in association with the Clementi (Orthic Black Chernozem) soils. They occur in landscapes which are considered to be in a discharge to weak recharge (groundwater) area and may have soluble salts within the rooting zone or subsoil. The runoff is slow, and permeability is moderately slow to slow.

The Beresford soils are characterized by a very dark gray to black Ah horizon 20 to 30 cm, a dark gray ACk horizon of six to 12 cm thick. A lime accumulation zone may occur in the loamy lacustrine sediments if the overlay is thick. The underlying strongly calcareous till of shale limestone and granitic origin is generally more compact.

Bermont Series (BMN)

The Bermont series consists of well drained, Rego Black Chernozem soils, developed on a thin mantle (50 to 75 cm) of very strongly to extremely calcareous, loamy glacial till of limestone and granitic origin, overlying strongly calcareous, loam to clay loam glacial till of shale, limestone and granitic origin. These soils occur in the upper slope and knoll positions of gently undulating to moderately rolling topography. Runoff is rapid. Permeability is moderate to moderately slow in the upper till, and slow in the lower till, which is generally more compact and weakly fissile.

The Bermont soil is characterized by a shallow Ah or a Ahk horizon 10 to 16 cm thick and an AC horizon of four to eight cm. This soil profile is similar to the Stewart series. It is associated with the well drained, Hilton and Tiger Hills series, the imperfectly drained Barwood series, and the poorly drained Hickson series.

Cactus Series (CCS)

The Cactus series consists of well drained, Rego Black Chernozem soils, developed on moderately calcareous, deep, stratified, coarse (FS, LFS, LS), lacustrine and deltaic deposits. These soils occur in upper slope and crest positions of gentle slopes on undulating duned landscapes. They have moderately rapid to rapid permeability, minimal surface runoff, and a low water table during the growing season. Cactus soils are highly prone to wind erosion, and are non-stony and non-saline.

They have a low available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes aspen, bur oak and tall prairie grasses. The majority of these soils are currently used for natural grazing.

In a representative profile of Cactus soil, the solum is approximately 15 cm thick. The profile is characterized by a very dark gray Ah horizon, 12 to 16 cm thick, a dark gray, calcareous, ACk horizon, four to eight cm thick, a thin Cca horizon, five to 10 cm thick with lime accumulation, and a light gray to pale brown Ck horizon. Cactus soils occur in close association with Stockton, Arizona and Sewell soils. They are similar to Stockton soils by having a well drained profile, developed in sandy deposits, but differ from them in having no Bm horizon. Cactus soils were previously mapped as minor Blackearth associates of the Stockton Association in the Carberry (1957) soil report.

Capell Series (CXT)

The Capell series consists of imperfectly drained Gleyed Rego Black Chernozem soils, developed on a mantle (25 to 100 cm) of moderately to strongly calcareous, stratified, loamy (SiL, L, CL), lacustrine sediments, over moderately to strongly calcareous, deep stratified, sandy to sandy-skeletal (GrS, GrLS), glaciofluvial deposits. These soils occur in lower slope positions of gentle to moderate slopes on hummocky landscapes, and have moderate to rapid permeability, moderate surface runoff and a medium water table during the growing season. Capell soils are occasionally slightly saline. They have medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation often includes tall prairie and meadow grasses. The majority of these soils are currently used for grain crop production.

In a representative profile of Capell soil, the solum is approximately 25 cm thick. The profile is characterized by a very dark gray to black Apk or Ahk horizon, 15 to 25 cm thick, a dark gray to gray, calcareous, ACk horizon, five to 15 cm thick, a light gray IICca horizon, five to 10 cm thick with secondary carbonate accumulation, and a light yellowish brown IICkgj horizon with common, distinct iron mottles.

The Capell Shaly Variant (CXT1) series is characterized by a Gleyed Rego Black Chernozem (carbonated) solum on an imperfectly drained thin mantle (25 to 90 cm) of moderately to strongly calcareous, loamy (L, CL, SiCL, SCL) sediments, overlying moderately to strongly calcareous, sand and gravel deposits, intermixed with varying amounts of shaly fragments.

Capell soils occur on level to very gently sloping topography or on the lower slope positions of undulating topography. These soils have moderately slow permeability in the upper sediments and rapid permeability in the lower coarser sediments, or restricted permeability during periods of subsoil saturation due to a perched condition or high water level. In some areas, where the water contains appreciable soluble salts, a sufficient concentration of salts may occur and inhibit or retard the growth of grasses or cereals. The solum has a very dark gray to black Ahk horizon, 15 to 24 cm thick, a dark gray to gray AC horizon, five to 15 cm thick. A lime accumulation horizon (Cca), eight to 12 cm thick, extends to or into the coarser materials. Brownish yellow mottles are common in the coarser sediments below. Capell soils occur in close association with Croyon and Carvey soils. Capell soils were mapped as an imperfectly drained associate of the Agassiz Association in the reconnaissance soil survey of South-Central Manitoba (1943).

Carroll Series (CXF)

The Carroll series is a Rego Black Chernozem soil, developed on moderately well to well drained, strongly to very strongly calcareous, moderately fine (SCL, CL, SiCL), lacustrine deposits. These soils occur in the Upper Assiniboine Delta and Brandon Lakes Plain on very gently sloping to undulating topography, in association with Ramada, Charman, Prodan and Tadpole soils. Surface runoff is moderately slow, and permeability is moderate. Careful management is required to reduce wind and water erosion, especially in undulating topography.

The Carroll soil profile has a very dark gray to black Ah or Ahk horizon, 15 to 20 cm thick, a dark gray AC horizon, 10 to 15 cm thick and a Cca horizon of lime carbonate accumulation, eight to 14 cm thick. The silty textured, pale brown Ck horizon is very erosive. This soil differs only slightly from the Ramada soil in not having a prominent Bm horizon. Carroll soils were previously mapped as the well drained associate of the Carroll Association in both the South-Central (1943) and Carberry (1957) soil reports.

Carvey Series (CAV)

The Carvey series consists of poorly drained Rego Humic Gleysol soils, developed on a mantle (25 to 100 cm) of moderately to strongly calcareous, uniform, loamy (SiL, L, SL) lacustrine sediments over moderately to strongly calcareous, sandy to sandy skeletal glaciofluvial deposits. These soils occur in depressional positions of nearly level slopes on level landscapes, and have moderate permeability, slow surface runoff and a high water table during the growing season. Carvey soils are occasionally slightly saline. They have medium over low available water holding capacity, high organic matter content, and medium natural fertility. Native vegetation often includes sedges and meadow grasses. The majority of these soils are currently used for natural grazing. In a representative profile of Carvey soil, the solum is approximately 20 cm thick. The profile is characterized by a thin (two to five cm), moderately decomposed LFH horizon, a very dark gray, calcareous, Ahk horizon, seven to 15 cm thick, a dark gray, calcareous, transition ACkg horizon, 10 to 20 cm thick, and a pale brown, calcareous, II Ckg horizon with yellowish brown mottles. A typical profile also contains manganese concretions in the subsoil and shells at the surface.

Carvey soils occur in close association with Capell, and Croyon soils. They are similar to Tadpole soils by having a Rego Humic Gleysol profile, developed in loamy lacustrine deposits, but differ from Tadpole soils by having a sandy to sandy-skeletal substrate within a metre of the mineral surface. Carvey soils were previously mapped as a Meadow associate with a loamy veneer of the Agassiz Association in the Carberry (1957) soil report.

The Carvey shaly variant, CAV1, series is characterized by a Rego Humic Gleysol (carbonated) solum on poorly drained thin mantle (25 to 90 cm) of moderately to strongly calcareous, loamy (L, CL, SiCL, SCL) lacustrine sediments, overlying moderately to strongly calcareous, sand and gravel deposits intermixed with varying amounts of shaly fragments. They occur in level to depressional sites, which have a water table at or near the surface for part of the year. Runoff is negligible. Permeability of the loamy sediments is moderately slow above the saturation zone. In areas where the seepage water contains soluble salts, a sufficient concentration of slats may occur in the soil to inhibit the growth of the normal sedge and meadow grasses. The solum has a moderately decomposed organic layer, two to five cm thick, a very dark gray carbonated Ahk horizon, seven to 15 cm thick, and a thin dark gray transitional ACg horizon. A lime accumulation layer (Cca) is commonly present. Yellowish brown mottles are common in the transitional ACg, the Ccag horizon and the subsoil.

Chambers Series (CBS)

The Chambers series is a Rego Black Chernozem soil, developed on moderately well to well drained, loamy (L, CL, SiCL), lacustrine sediments, less than one metre in depth, overlying moderately to strongly calcareous, loamy (L, CL) glacial till deposits. These soils occur in the upper slope positions of gently sloping to hummocky, moderately rolling topography. Surface runoff is moderately rapid to rapid, depending on the slope gradient. Permeability is moderate in the lacustrine sediments and moderately slow to slow in the glacial till deposit. The Chambers soil profile is characterized by a very dark gray to black Ah or Ahk horizon of 10 to 15 cm thick, a thin dark gray to grayish brown ACk horizon, three to eight cm thick, and a thin lime accumulation zone. The underlying till is a light yellowish brown color. Chambers soil series tend to be less stony than the very similar Rufford soils.

Charman Series (CXV)

The Charman series consists of imperfectly drained Gleyed Black Chernozem soils, developed on strongly to very strongly calcareous, fine loamy (CL, SiCL), lacustrine deposits. In areas of seepage or discharge, soluble salts in the subsoil can be translocated near the surface in sufficient quantities to affect crop growth. These soils occur in middle positions of very gentle slopes on undulating landscapes and have moderate permeability, slow surface runoff, and a medium high water table during the growing season. Charman soils are non-eroded, non-stony, and frequently slightly saline. They have a moderately high available water holding capacity, high organic matter content, and medium natural fertility. Native vegetation includes aspen, willows, shrubs and prairie grasses. The majority of these soils are currently cultivated for crop production.

In a representative profile of Charman soil, the solum is approximately 40 cm thick. The profile is characterized by very dark gray to black Ap or Ah horizon, 15 to 25 cm thick, a dark grayish brown Bmgj horizon, 12 to 30 cm thick, a transitional BCgj horizon, five to eight cm thick, and a pale brown, silty textured Ckgj horizon, with iron mottles and frequently gypsum crystals.

Charman soils occur in close association with Ramada, Carroll and Tadpole soils. They are similar to Prodan soils by having an imperfectly drained profile and fine loamy deposits, but differ from them in having a Bmgj horizon. Charman soils were previously mapped as Black-Meadow associates of the Holland Association in the Carberry (1957) soil report.

Clementi Series (CLN)

The Clementi series is characterized by an Orthic Black Chernozem profile, developed on a thin mantle (25 to 90 cm) of loamy lacustrine sediments over moderately to very strongly calcareous, morainal till of limestone, granitic and shale origin. These soils are moderately well drained, and occur in mid to upper slope positions of very gently undulating or rolling topography. Runoff is moderate. Permeability is moderate in the loamy overlay, and moderately slow to slow in the underlying till. The solum has a very dark gray to black Ah horizon, 10 to 20 cm thick and a dark brown to brown Bm horizon, eight to 12 cm thick. The solum is developed dominantly within the overlay, and may extend into the till material.

Cobfield Series (CBF)

The Cobfield series is a Gleyed Black Chernozem soil, developed on imperfectly drained loamy (L, CL, SiCL) lacustrine sediments, less than one metre in depth, overlying moderately to strongly calcareous, loamy (L, CL) glacial till deposits. These soils occur in the mid to lower slope position of gently sloping to undulating topography of dominantly weak recharge areas. The runoff is moderately slow, with permeability being moderate in the upper lacustrine sediments and moderately slow to slow in the underlying glacial till. The Cobfield soil profile is characterized by a very dark gray to black Ap or Ah horizon 10 to 18 cm thick, a brown to dark yellowish Bm horizon of eight to 12 cm thick, with few, yellowish brown to strong brown mottles, and a lime accumulation horizon (Ccagj). The underlying till is olive brown to light olive brown, which is indicative of periodic saturation and reducing conditions.

Cordova Series (CVA)

The Cordova series is characterized by a Calcareous Black Chernozem solum on moderately to strongly calcareous, fine loamy (L, SiCL, CL) morainal till of mixed limestone, granitic and shale rock origin. These soils are well to rapidly drained and occur in the upper slope and crest positions of undulating to hummocky landscapes, in close association with the well drained Rufford and Newdale series. Surface runoff is moderately rapid to rapid, depending upon slope. Permeability is moderately slow. Native vegetation consists of mixed tall prairie grasses and herbs.

The Cordova soil profile has a thin, very dark gray Ap(k) horizon, 12 to 18 cm thick, a calcareous, yellowish brown to dark yellowish brown Bmk horizon, five to 15 cm thick, a thin transitional BCk

horizon, and a light gray lime carbonate accumulation layer, 25 to 35 cm thick. Secondary carbonates may be found along vertical cracks within the underlying grayish brown (dry) or dark grayish brown (moist) Ck horizon. In many areas, these soils have been altered by wind and water erosion. The crest positions have lost most of the A horizon and part of the B horizon has been cultivated. In a few areas, the Cca horizon has been incorporated into the plow layer, imparting a light gray surface color.

The Cordova series differs from the Rufford series, a carbonated Rego Black, in having a Bmk horizon. Both Cordova and Rufford series differ from the Newdale series, the former having free lime carbonate present in the solum, while the latter has an A and B horizons free of carbonates.

Crookdale Series (CKD)

The Crookdale series consists of imperfectly drained Gleyed Rego Black Chernozem soils, developed on a mantle (25 to 100 cm) of strongly calcareous, stratified, fine loamy (CL, SiCL) lacustrine sediments over strongly calcareous, deep uniform sandy (LFS, FS, S) fluvial lacustrine deposits. These soils occur in lower slope positions of level to nearly level slopes on level landscapes, and have moderate permeability, moderately slow surface runoff, and a medium water table during the growing season. Crookdale soils are non-eroded, non-stony and slightly saline. They have high available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation often includes tall prairie grasses. The majority of these soils are currently used for grain crop production.

In a representative profile of Crookdale soil, the solum is approximately 25 cm thick. The profile is characterized by a black Ap or Ah horizon, 10 to 25 cm thick, a dark grayish brown transitional AC horizon, 10 to 20 cm thick with faint iron mottles, a white Ccagj horizon, five to 10 cm thick of lime accumulation, and a light olive brown II Ckgj horizon with prominent iron mottles.

Crookdale soils occur in close association with Wellwood soils. They are similar to Prodan soils by having a Gleyed Rego Black profile, developed in fine loamy lacustrine deposits. However, they differ from Prodan soils, which develop in deep fine loamy deposits by grading to sandy deposits at depth. Crookdale soils were previously mapped as an associate of the Glenboro association in the reconnaissance soil survey of South-Central Manitoba (1943).

Croyon Series (CYN)

The Croyon series consists of moderately well to well drained, Orthic Black Chernozem soils, developed on a mantle (25 to 100 cm) of moderately to strongly calcareous, uniform, loamy (L, SiL, CL) lacustrine sediments over moderately to strongly calcareous, stratified, deep sandy-skeletal (GrS, GrLS), glacio-fluvial deposits. These soils occur in middle and upper slope positions of very gentle slopes on undulating landscapes, and have medium over rapid permeability, moderately rapid surface runoff, and a low water table during the growing season. Croyon soils have medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation often includes tall prairie grasses interspersed with aspen-oak groves. The majority of these soils are currently used for grain crop production.

In a representative profile of Croyon soil, the solum is approximately 35 cm thick. The profile is characterized by a very dark gray Ah or Ap horizon, 10 to 15 cm thick, a dark brown Bm horizon, 10 to 25 cm thick, a yellowish brown II Cca horizon, 10 to 20 cm thick, with secondary carbonate accumulation and a light yellowish brown IICk horizon. The parent material is typically stratified with thin (<5 cm) layers of SiL, CoS, GrS and SL textures.

The Croyon series shale gravel variant, (CYN1) occurs in close association with typical Croyon soils and differs in having dominantly shale derived coarse fragments in the sandy-skeletal substrate.

The Croyon series sandy substrate variant (CYN2), occurs in close association with typical Croyon soils and differs in having dominantly sandy substrate, rather than sandy-skeletal substrate deposits.

Croyon soils occur in close association with Capell soils. They are similar to Vandal (Orthic Dark Gray Chernozem) soils by having a coarse-loamy mantle over sandy-skeletal deposits at depth, but differ in having a less strongly developed Orthic Black Chernozem soil profile. Croyon soils were previously mapped as loamy surface associates of the Agassiz association in the reconnaissance soil survey of South-Central Manitoba (1943).

Dogand Series (DGA)

The Dogand series consists of well to moderately well drained, Calcareous Black Chernozem soils, developed on a sequence of soil materials composed of a thin mantle, (25 to 60 cm) of moderately to strongly calcareous, loamy sediments over thin (10 to 40 cm) medium sand to gravel strata, over a very strongly calcareous, loamy textured glacial till. Strongly calcareous, loam to clay loam glacial till of shale, limestone and granitic origin usually occurs within a two-metre depth. The soils occur on gently sloping topography. Runoff is moderate. Permeability is moderate to rapid in the upper loamy and coarser strata and moderately slow in the underlying till.

A very dark gray Ahk horizon 10 to 15 cm thick, a brown to dark grayish brown Bmk horizon of eight to 12 cm thick and a thin BCk characterize the soil. A calcium carbonate layer (Cca) occurs at the contact of the loamy sediments and the coarser strata.

Dorset Series (DOT)

The Dorset series consists of moderately well to well drained, Orthic Black Chernozem soils, developed on moderately to strongly calcareous, deep , stratified, sandy to sandy skeletal (S, GrS, GrCoS), outwash and glaciofluvial deposits. These soils occur in upper positions of gentle slopes on hummocky landscapes and have very rapid permeability, low rapid surface runoff, and a low water table during the growing season. Dorset soils are non-eroded, non-stony, and non-saline. They have a low available water holding capacity, low organic matter content, and low natural fertility. Native vegetation includes aspen-oak stands and tall prairie grasses. The majority of these soils are currently used for grazing or are excavated for gravel deposits.

In a representative profile, the solum is approximately 30 cm thick. The profile is characterized by a very dark gray Ah horizon, 12 to 18 cm thick, a dark brown Bm horizon, 15 to 22 cm thick, a Cca (lime accumulation) horizon, six to 12 cm thick and a light brown Ck horizon, with stratified sand and gravel. The Dorset, shaly gravel variant, DOT1, has a high proportion of shale fragments in the gravel.

Dorset soils occur in close association with Mansfield soils. They are similar to Marringhurst soils by having well drained profile in glaciofluvial deposits, but differ from them in having a Bm horizon. Dorset soils were previously mapped as Blackearth associates of the Marringhurst Association in the Carberry (1957) soil report.

Drokan Series (DRO)

The Drokan series is characterized by a Rego Humic Gleysol (carbonated) solum, developed on moderately to strongly calcareous, fine loamy (L, SiCl, CL) morainal till of limestone, granitic and shale rock origin. They are poorly to very poorly drained and occur in depressional positions of the undulating to hummocky morainal landscape. Surface runoff is negligible and the soils may remain in a ponded condition, unless the surface drainage has been improved. Permeability is moderately slow to slow. In some landscapes, these areas are influenced by seepage from adjacent higher lands, and may have a considerable content of soluble salts. Native vegetation consists of sedges, cattails, rushes and willows. Saline areas have baltic rush, wild barley and saline goosefoot.

The Drokan soil profile has a moderately decomposed organic layer, two to five cm thick, a very dark gray Ah horizon, 10 to 35 cm thick, a mottled transitional ACg horizon, four to eight cm thick, and a

lime accumulation layer, eight to 12 cm thick. The Cg horizon is olive gray to olive, with yellowish brown mottles. Gypsum crystals are common in the lime accumulation layer and Ccag horizon. In saline areas, white flecks of salt and gypsum are present in the Ah and ACg horizons. Soils with appreciable soluble salt are delineated as Drokan saline phase. Drokan soils are similar, but differ from the closely related Penrith soil series in being less well developed and having shallower, less distinct horizons.

Druxman Series (DXM)

The Druxman series consists of imperfectly drained Gleyed Black Chernozem soils, developed on a mantle (25 to 100 cm) of moderately to strongly calcareous, stratified, fine loamy (SiL, L, CL, SiCL), lacustrine sediments, over moderately to strongly calcareous, deep, sandy-skeletal (GrS, GrLS), glacio-fluvial deposits. These soils occur in lower slope positions of very gentle slopes on undulating landscapes and have medium over rapid permeability, low surface runoff, and a medium water table during the growing season. Druxman soils have medium available water holding capacity, medium organic matter content and medium natural fertility. Native vegetation often includes meadow and tall prairie grasses interspersed with willow clumps. The majority of these soils are currently used for grain crop production.

In a representative profile, the solum is approximately 50 cm thick. The profile is characterized by a very dark gray Ah or Ap horizon, 15 to 25 cm thick, a dark yellowish brown to olive brown Bmgj horizon, 20 to 30 cm thick, with many, fine, distinct, yellowish brown iron mottles, a transitional dark yellowish brown BCgj, five to 10 cm thick, occasionally a yellowish brown II Ccagj horizon, five to 10 cm thick and light yellowish brown II Ckgj horizon, with many, large prominent iron mottles.

Druxman and Druxman, shaly variant (DXM1) soils occur in close association with Croyon and Carvey soils. They are similar to Capell soils by having an imperfectly drained Black profile, developed in loamy over sandy-skeletal deposits. But they differ from Capell soils, because Capell soils lack a Bmgj horizon. Druxman soils were previously mapped as imperfectly drained associates of the Agassiz Association in the reconnaissance soil survey of South-Central Manitoba (1943).

Durnan Series (DRN)

The Durnan series consists of moderately well to well drained, Rego Black Chernozem soils, developed on strongly to very strongly calcareous, deep, stratified, medium textured (VFSL, L, SiL), lacustrine deposits. These soils occur in upper slope and crest positions of gentle slopes on hummocky to undulating landscapes, and have moderate to moderately rapid permeability, moderate to rapid surface runoff, and a low water table during the growing season. Durnan soils are occasionally slightly eroded, non-stony and non-saline. They have medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation includes aspen, oak, prairie grasses and shrubs. The majority of these soils are currently cultivated for crop production.

In a representative profile, the solum is approximately 10 cm thick. The profile is characterized by a very dark gray Apk or Ahk horizon, 10 to 15 cm thick, frequently a Cca horizon, four to seven cm thick, and a pale brown, calcareous, Ck horizon.

Durnan soils occur in close association with Fairland, Torcan and Vordas soils. They are similar to Traverse soils by having a well drained profile in coarse loamy deposits, but differ from them in having no Bmk horizon. Durnan soils were previously mapped as Blackearth associates of the Holland Association in the Carberry (1957) soil report.

Everton Series (EVO)

The Everton series consists of moderately well to well drained, Orthic Black Chernozem soils, developed on a thin mantle (25 to 75 cm) of silty clay to clay sediments over a thin strata (10 to 40 cm)

of very strongly calcareous, loamy glacial till of shale, limestone and granitic origin over a strongly calcareous till of shale, limestone and granitic origin. The soils occur on gently sloping topography. Runoff is moderate and permeability is moderately slow to slow.

The soil is characterized by a granular, very dark gray to black Ah horizon, 10 to 15 cm thick, a dark grayish brown to brown, fine subangular blocky Bm horizon eight to 14 cm thick, and a pale brown BCk horizon. In areas where the clay overlay is not too deep, the solum extends to the contact of the clay and the very strongly calcareous glacial till, which appears as a prominent Cca horizon.

Fairland Series (FND)

The Fairland series consists of moderately well to well drained, Orthic Black Chernozem soils, developed on strongly to very strongly calcareous, deep, stratified, medium textured (VFSL, L, SiL), lacustrine deposits. These soils occur in upper positions of gentle slopes on rolling landscapes and have moderate permeability, moderate surface runoff, and a low water table during the growing season. Fairland soils are often slightly eroded, non-stony and non-saline. They have a medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation includes aspen, oak, shrubs and prairie grasses. The majority of these soils are currently cultivated for crop production.

In a representative profile, the solum is approximately 25 cm thick. The profile is characterized by a very dark gray to very dark grayish brown Ap horizon, 10 to 15 cm thick, a brown to dark brown Bm horizon, 10 to 15 cm thick, a pale brown BC horizon, five to 10 cm thick, with carbonates and a light gray Cca horizon, five to 10 cm thick, with lime accumulation. The parent material is typically very pale brown and calcareous.

Fairland soils occur in close association with Traverse, Taggart and Vordas soils. They are similar to Durnan soils by having well developed profile in loamy deposits, but differ from them in having a strongly developed Bm horizon. Fairland soils were previously mapped as Blackearth associates of the Holland Association in the Carberry (1957) soil report.

Fenton Series (FET)

The Fenton series consists of poorly drained, carbonated Rego Humic Gleysol soils, developed on a thin mantle (25 to 75 cm) of silty clay to clay sediments, over a a moderately to very strongly calcareous, loamy glacial till of limestone and granitic origin, over a strongly calcareous, loam to clay loam glacial till of shale, limestone and granitic origin. These soils occur in level to depressional topography and are subject to ponding and prolonged wetness. Runoff is very slow; permeability is slow to very slow. Some salts may occur in the soil in areas of seepage or upward movement of groundwater containing appreciable soluble salts toward the surface.

The soil is characterized by a thin, moderately decomposed organic layer two to five cm thick, a very dark gray Ah horizon, eight to 12 cm thick, a thin olive gray AC horizon, and olive Cg horizon that may have some yellowish brown mottles. Silt-sized, pseudomycelium of magnesium sulfate or gypsum may be present in the surface horizon of saline areas.

Forrest Series (FRT)

The Forrest series consists of imperfectly drained Gleyed Rego Black Chernozem soils, developed on a thin mantle (25 to 75 cm) of silty clay to clay sediments over a thin strata (10 to 40 cm) of very strongly calcareous, loamy glacial till of shale, limestone and granitic origin. The topography is level to very gently sloping. Runoff is moderately slow to slow, and permeability is moderately slow to slow. These soils are influenced by a subsoil seepage condition in the very strongly calcareous till, and an upward pressure of groundwater. Soluble salts are usually found in the subsoil.

The soil is characterized by an irregular, very dark gray Ah or Ahk horizon, 10 to 15 cm thick, with tongues to 25 cm, and a dark gray to olive gray AC(k), four to eight cm thick. A weakly mottled, calcareous, light olive brown Ckgj horizon is also present.

Gateside Series (GTD)

The Gateside series consists of imperfectly drained Gleyed Black Chernozem soils, developed on moderately to strongly calcareous, deep, coarse, loamy (VFS, LVFS, FSL, SL) lacustrine deposits. These soils occur in middle positions of very gentle to nearly level slopes on undulating landscapes and have moderately rapid permeability, moderately slow surface runoff, and a high water table during the growing season. Gateside soils are non-stony, and occasionally slightly saline. They have a medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation includes tall prairie grasses, aspen-oak groves, shrubs and meadow grasses. The majority of these soils are currently cultivated for crop production.

In a representative profile, the solum is approximately 35 cm thick. The profile is characterized by a very dark gray to black Ap or Ah horizon, 12 to 18 cm thick, a brown to olive brown Bmgj horizon, 15 to 30 cm thick with faint iron mottles, a light olive brown BCkgj horizon, five to 15 cm thick with carbonates, and a light olive brown to yellowish brown Ckgj horizon with distinct yellowish brown mottles.

Gateside soils occur in close association with Prosser, Pleasant and Poolex soils. They are similar to Pleasant soils by having imperfect drainage in coarse loamy deposits, but differ from them in having a Bmgj horizon. Gateside soils were previously mapped as Black Meadow associates of the Holland Association in the Carberry (1957) soil report.

Gendzel Series (GDZ)

The Gendzel series consists of imperfectly drained, carbonated, Gleyed Rego Black Chernozem soils, developed on a thin mantle (25 to 60 cm) of moderately to strongly calcareous, sandy textured sediments, overlying moderately to strongly calcareous, medium sand to gravelly textured sediments. The soil occurs in a level to gently sloping topography. Runoff is moderately slow. Permeability is moderately rapid to rapid, but may be restricted in the subsoil during periods when the water table is high.

The soil is characterized by a very dark gray to black Ahk horizon, 10 to 16 cm thick, a dark gray to light gray AC horizon, five to nine cm thick, and a lime accumulation (Cca) horizon, six to 12 cm thick. In the soils with a shallow solum, the lime accumulation (Cca) horizon occurs at the transition of the sandy to gravelly sediments.

Glenboro Series (GBO)

The Glenboro series consists of moderately well to well drained, Orthic Black Chernozem soil, developed on a mantle (25 to 90 cm) of moderately to strongly calcareous, shallow, medium textured (VFSL, L, SiL) lacustrine deposits, over moderately calcareous, stratified, deep, sandy (FS, LFS, LS) deposits. These soils occur in upper positions of gentle slopes on sloping to undulating landscapes and have moderate over moderately rapid permeability, moderately slow surface runoff, and a low water table during the growing season. Glenboro soils are often slightly eroded, non-stony, and non-saline. They have a medium available water holding capacity, high organic matter content, and high natural fertility. Native vegetation includes tall prairie grasses and aspen-oak groves. The majority of these soils are currently cultivated for crop production.

In a representative profile, the solum is approximately 30 cm thick. The profile is characterized by a very dark gray to black Ap or Ah horizon, 12 to 18 cm thick, with granular structure, a dark brown to

brown Bm or Btj horizon, 10 to 16 cm thick, with subangular blocky structure, a brown to pale brown BC horizon, six to 14 cm thick, and a light gray to very pale brown Cca horizon, five to eight cm thick. The parent material is typically pale brown to light yellowish brown sandy. Some stratified sands to loams may occur in the loam/sand transition.

The Glenboro, clay loam to silty clay loam, variant, (GBO1) contains a clay loam to silty clay loam layer in the subsoil above the sandy deposits.

Glenboro soils occur in close association with Grover and Grayson soils. They are similar to Fairland soils by having an Orthic Black Chernozem profile and loamy surface mantle, but differ from them in having a sandy substrate. Glenboro soils were previously mapped as Blackearth associates of the Glenboro Association in the Carberry (1957) soil report.

Grayson Series (GYS)

The Grayson series consists of poorly drained Rego Humic Gleysol soils, developed on a thin mantle (25 to 95 cm) of moderately to strongly calcareous, medium textured (VFSL, L, SiL) sediments, grading to moderately calcareous, sandy (FS, LFS, LS) deposits. The soils occur in level to depressional topography and have a saturation zone at or very near the surface for a considerable time. Runoff is very slow to negligible. Permeability of the soil material is moderate, but restricted during periods when the soil is saturated.

The soil is characterized by a thin, moderately decomposed organic layer, two to five cm thick, a very dark Ah or Ahk horizon, eight to 12 cm thick, and a dark gray AC. In some soils, thin cumulic layers of organic and mineral matter may be present at the surface. A lime carbonate horizon is often present below the AC. The subsoil (Cg) is light olive brown to olive, and may have yellowish brown mottles.

Gregg Series (GRG)

The Gregg series consists of imperfectly drained Gleyed Eluviated Black Chernozem soils, developed on fine loamy (CL, SiCL) to clayey (SiC, C) lacustrine sediments, underlain by stratified loamy fine sand (LFS) to stratified fine sand (FS) deposits at depths of 1.2 to 1.8 metres. These soils occur in depressional positions in level to nearly level landscapes and have low permeability. A Btgj horizon (clay accumulation), with a thickness of up to one metre, results in slow downward movement of water. They have moderately high available water holding capacity, average organic matter and medium natural fertility. Due to landscape position, these soils will pond water during heavy summer precipitation events, resulting in crop drown-outs. Native vegetation includes aspen, willow, shrubs and prairie grass. The majority of these soils are currently cultivated for grains, oilseed, and special crops.

In a representative profile, the solum is approximately 100 cm thick. The profile is characterized by a very dark gray to dark gray Ap horizon, 15 cm in thickness, a dark gray to gray Aegj horizon, 10 to 15 cm thick, a transitional dark grayish brown AB horizon, 10 cm thick, a dark brown Btgj horizon, 50 to 75 cm in thickness, a transitional BC horizon about 10 cm thick, and a Cgj horizon. Gregg soils occur in close association with well drained, Ramada and Wellwood soils. They differ by having an imperfectly drained profile and an illuviated Btgj horizon.

Grover Series (GRO)

The Grover series consists of imperfectly drained Gleyed Rego Black Chernozem soils, developed on a mantle (25 to 75 cm) of moderately to strongly calcareous, shallow, medium textured (VFSL, L, SiL) lacustrine deposits, over moderately calcareous, deep, sandy (FS, LFS, LS), lacustrine deposits. These soils occur in middle positions of very gentle slopes on undulating landscapes and have moderate over moderately rapid permeability, moderately slow surface runoff, and a high water table during the growing season. Grover soils are non-eroded, non-stony, and non-saline. They have

medium available water holding capacity, high organic matter content, and medium natural fertility. Native vegetation includes aspen oak, ash and tall prairie grasses. The majority of these soils are currently cultivated for crop production.

In a representative profile, the solum is approximately 20 cm thick. The profile is characterized by a very dark gray to black Ap, Ah or Ahk horizon, 15 to 25 cm thick, a dark grayish brown AC horizon, 15 to 20 cm thick with faint mottles, a Ccagj horizon, five to eight cm thick, and a light yellowish brown, sandy Ckgj horizon, with yellowish brown mottles. Grover soils occur in close association with Glenboro and Grayson soils. They are similar to Crookdale soils by being imperfectly drained with a sandy substrate, but differ from them by having loamy, rather than fine loamy, surface. Grover soils were previously mapped as Black Meadow associates of the Glenboro Association in the Carberry (1957) soil report.

Harding Series (HRG)

The Harding series consists of imperfectly drained Gleyed Black Chernozem soils, developed on moderately to strongly calcareous, silty clay to clay lacustrine deposits. These soils occur on level to very gently sloping topography. Runoff is slow. Permeability is moderately slow to slow. Most of these soils occur within a discharge region characterized by an upward pressure of groundwater or a lateral flow of water through the underlying, very strongly calcareous till, which may occur at a depth of one to two metres. Appreciable soluble salts may be present within the rooting zone and gypsum crystals are common.

The soil is characterized by a very dark gray Ah horizon, 12 to 22 cm thick, and a dark grayish brown, prismatic to subangular blocky Bmgj horizon, 15 to 20 cm thick, with fine yellowish brown mottles. A lime accumulation horizon (Ccagj) is also common. Salt pseudomycelium and gypsum concretions are common in the olive brown to olive Ckgj horizon.

Hickson Series (HKS)

The Hickson series consists of poorly drained carbonated Rego Humic Gleysol soils, developed on a thin mantle (50 to 75 cm) of very strongly to extremely calcareous, fine loamy (L, SiL, SiCL, CL) glacial till of limestone and granitic origin, overlying strongly calcareous, loam to clay loam glacial till of shale, limestone, and granitic origin. They occur in level to depressional (pothole) topography and are subject to ponding and prolonged saturation. Runoff is negligible, and permeability is very slow. Soluble salts may occur within the soil in areas of seepage or upward movement of groundwater containing appreciable soluble salts toward the surface.

The soil is characterized by a moderately decomposed organic layer, two to 5 cm thick, a very dark gray, carbonated Ah horizon, and a thin gray to olive gray ACg horizon with mottles. The Ckg horizon is pale olive and may contain yellowish brown mottles.

Hilton Series (HIT)

The Hilton series consists of well drained, Orthic Black Chernozem soils, developed on strongly to extremely calcareous, thin, uniform, fine loamy (L, CL, SiCL) glacial till of limestone, shale and granite origin. These soils occur in upper slope positions of moderate slopes on hummocky landscapes, and have moderate permeability, rapid surface runoff, and a low water table during the growing season. Hilton soils are moderately eroded, moderately stony and non-saline. They have medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation often includes tall prairie grasses, interspersed with aspen-oak groves. The majority of these soils are currently used for forage crop production and improved pasture.

In a representative profile, the solum is approximately 30 cm thick. The profile is characterized by a very dark gray Ah or Ap horizon, 10 to 20 cm thick, a dark brown Bm horizon, five to 15 cm thick, a

very pale brown Cca horizon, 10 to 40 cm thick, and a yellowish brown Ck horizon. The parent material is typically very stony.

Hilton soils occur in close association with the imperfectly drained Barwood series and the poorly drained Hickson soils. They are similar to Tiger Hills soils by having a well drained, very thin soil profile, developed in strongly to extremely calcareous glacial till. But they differ from them in having a less strongly leached soil profile. Tiger Hills soils have Ae or Ahe horizons and Bt horizons, while Hilton soils do not. Hilton soils were previously mapped as dominant associates of the Hilton association in the reconnaissance soil survey of South-Central Manitoba (1943).

Janick Series (JIK)

The Janick series consists of well to moderately well drained, Orthic Black Chernozem soils, developed on moderately to strongly calcareous, deep, uniform, clayey (C, SiC), lacustrine deposits. These soils occur in upper positions of nearly level slopes on undulating landscapes and have slow permeability, moderately slow surface runoff, and a medium water table during the growing season. Janick soils are non-eroded, non-stony, and non-saline. They have a high available water holding capacity, high organic matter content, and high natural fertility. Native vegetation includes prairie grasses. The majority of these soils are currently cultivated for crop production.

In a representative profile, the solum is approximately 30 cm thick. The profile is characterized by a very dark gray to black Ap or Ah horizon, 10 to 18 cm thick, a dark grayish brown to brown Bm horizon, eight to 15 cm thick, with fine subangular blocky structure, a pale brown BC horizon, five to 10 cm thick, weakly calcareous, and a light grayish brown to pale brown Ck horizon, with a few faint mottles. Janick soils occur in close association with Harding soils.

Jaymar Series (JAY)

The Jaymar series consists of well drained, Orthic Black Chernozem soils, developed on stratified materials composed of a thin mantle (40 to 70 cm) of moderately to strongly calcareous, loamy (L, SiCl, CL), lacustrine sediments over a thin, 30 to 60 cm contact zone of sandy skeletal (S, GrS) materials, overlying moderately to strongly calcareous, loamy (L, CL, SiCL), glacial till of shale, limestone and granitic rock origin. The soils occur on very gently to gently sloping topography, runoff is moderate, and permeability is moderate to rapid in the upper loamy and sandy skeletal strata and moderately slow in the underlying till. These soils are often stony, due to the modification of the till.

The soil is characterized by a very dark gray Ah horizon, 10 to 15 cm thick, a dark brown to brown Bm horizon, eight to 15 cm thick, and a lime accumulation layer (Cca) that occurs at the contact of the loamy sediments and underlying coarser wash zone. Jaymar soils occur as well drained inclusions of the Heaslip Complex in the South-Central Manitoba (1943) soil report.

Justice Series (JUC)

The Justice series consists of imperfectly drained Gleyed Black Chernozem soils, developed on a thin mantle (25 to 75 cm) of silty clay to clay sediments, over a thin strata (10 to 40 cm) of very strongly calcareous, loamy glacial till of shale, limestone and granitic origin, over a strongly calcareous till of shale, limestone and granitic origin. The topography is level to gently sloping. Runoff is slow and permeability is moderately slow to slow. These soils are influenced by a subsoil seepage condition in the very strongly calcareous till and an upward pressure of groundwater. Although these soils are not saline, some of the adjacent soil types have appreciable soluble salts within their solum.

The soil is characterized by a very dark gray Ah horizon, 12 to 22 cm thick, a dark grayish brown, prismatic to subangular blocky Bmgj horizon, 15 to 20 cm thick, with fine yellowish brown mottles. A calcium carbonate accumulation horizon is common (Ccagj). Where the clay overlay is shallow, the depth of solum extends to the contact of the very strongly calcareous till.

Knolls Series (KLS)

The Knolls series is an Orthic Regosol soil, developed on well to excessively drained, strongly to very strongly calcareous, loamy (VFSL, L, SiL), lacustrine sediments. These soils occur on the Brandon Lakes Plain and Upper Assiniboine Delta in the upper slope and knoll positions on gently undulating to moderately rolling topography, in association with Fairland, Durnan, Torcan, Taggart and Vordas soil series. Surface runoff is moderate to rapid, and permeability is moderate. These soils are severely eroded remnants of Fairland and Durnan soils, whose surface horizons have been removed by wind and water erosion. They continue to be very susceptible to both wind and water erosion.

The Knolls soil profile has a gray to light gray, calcareous, Ap horizon, 10 to 15 cm thick, that is slightly darker in color than the light yellowish brown to pale brown C horizon.

Kerran Series (KRN)

The Kerran series consists of poorly to very poorly drained Rego Humic Gleysol soils, developed on moderately to strongly calcareous, deep, stratified, clayey (SiC, C), recent alluvial deposits with strata of silty clay loam and clay loam textures. These soils occur in depressional positions of level slopes on flood prone terraced landscapes and have very slow permeability, very slow surface runoff, and a high water table during the growing season. Kerran soils are non-eroded, non-stony, and frequently moderately saline. They have a high available water holding capacity, high organic matter content, and low natural fertility. Native vegetation includes reeds, rushes, sedges and willows. The majority of these soils are currently in native vegetation.

In a representative profile, the solum is not developed. The profile is characterized by a thin organic horizon, two to four cm thick, a weakly developed dark gray Ahk horizon, 10 to 15 cm thick, and a pale brown to light gray Ckg horizon, with prominent iron mottles. The parent material is typically stratified, mottled, and may contain buried former Ah horizons. Kerran soils occur in close association with Assiniboine soils. They are similar to Barker soils, by having a poorly drained profile in recent alluvium, but differ from them in having finer textures throughout the profile. Kerran soils were previously mapped as associates of the Assiniboine Complex in the Carberry (1957) soil report.

Kilmury Series (KUY)

The Kilmury series consists of imperfectly drained Gleyed Rego Black Chernozem soils, developed on a thin mantle (<1 m) of moderately to strongly calcareous sediments of VFS, LVFS, SL and FSL texture, overlying moderately to strongly calcareous, stratified medium sands to gravelly textured deposits. They occur in close association with Wytonville series, the well drained Miniota series and the poorly drained Bornett series. The topography is level to very gently sloping. Runoff is moderately slow. Permeability is moderately rapid in the very fine sandy sediments and rapid in the subsoil, but restricted by a high water table during spring and early summer.

The soil is characterized by a very dark gray Ah horizon, 20 to 35 cm thick, a dark gray to grayish brown AC horizon, 10 to 16 cm thick, and a Ccagj horizon 10 to 18 cm thick. Yellowish brown mottles are common in the sandy and coarser subsoil. Kilmury profiles differ from Wytonville profiles in not having a Bmgj horizon and in having free lime carbonate in their Ah horizons.

Kleysen Series (KYS)

The Kleysen series consists of moderately well to well drained, Calcareous Black Chernozem soils, developed on a thin mantle (25 to 60 cm) of loamy, lacustrine sediments over a moderately to very strongly calcareous, loam to clay loam till of shale, limestone and granitic origin. These soils in the upper slope positions are of gently sloping, undulating or rolling topography. Runoff is moderate to moderately rapid. Permeability is moderate in the lacustrine sediments and in the loose, very strongly

calcareous till, and moderately slow to slow in the more compact, somewhat fissile loam to clay loam till.

The soil is characterized by a very dark gray to black Ah horizon, 10 to 14 cm thick, and a brown to dark brown calcareous, Bmk horizon, eight to 12 cm thick. The solum usually extends to the contact of the very strongly calcareous till. A description of a representative Kleysen soil is described below.

Ah - 0 to 17 cm, very dark gray (10YR 3/1 dry, 10 YR2.5/1 moist) silty clay loam, weak, fine subangular blocky; very friable when moist; slightly hard when dry; plastic; mildly alkaline; non-calcareous; clear, smooth boundary
Bmk - 17 to 30 cm, brown (10YR 4.5/3 dry, 10YR 3.5/3 moist) silty clay loam; weak to moderate, fine subangular blocky; friable when moist; slightly hard when dry; plastic; moderately alkaline; strongly calcareous; clear, wavy boundary
II Cca - 30 to 45 cm, light gray to very pale brown (10YR 7/2.5 dry, 10YR 5.5/3.5 moist) silty clay loam (till); very weak, fine, pseudo granular; very friable when moist; hard when dry; plastic; strongly alkaline; extremely calcareous; clear, irregular boundary
II Ck - 45 to 80 cm, very pale brown (10YR 7.5/3 dry, 10YR 5.5/4 moist) silt loam (till); weak, fine to medium, pseudo, subangular blocky; friable when moist; hard when dry; plastic; strongly alkaline; extremely calcareous; abrupt, smooth boundary
III Ck - 80 to 100 cm, pale brown (10YR 6/3 dry, 10YR4.5/4 moist) loam (till); weak to moderate, fine to medium subangular blocky; friable when moist; slightly hard when dry; plastic; moderately alkaline; very strongly calcareous; contains significant amounts of shale fragments

Lavenham Series (LVH)

The Lavenham series is a Gleyed Black Chernozem soil, developed on imperfectly drained, weakly to moderately calcareous, sandy (FS, LFS, LS), lacustrine sediments. These soils occur in the Upper Assiniboine Delta on level to very gently sloping topography, in association with Stockton, Cactus, Hummerston and Sewell soils. Surface runoff is slow, and permeability is moderately rapid. Downward movement of water is restricted in the subsoil during periods of high water table. The water table ranges from one metre shortly after spring runoff, to three metres below the surface in late fall and winter. These soils are also susceptible to erosion.

The Lavenham soil profile has a very dark gray to very dark brown Ah horizon, 18 to 25 cm thick, a dark brown to yellowish brown Bmgj horizon, 20 to 40 cm thick, with distinct brown mottles in the lower part of the horizon, a lime carbonate accumulation (Ccagj) horizon, 12 to 20 cm thick, and a pale brown Ckgj horizon, with distinct to prominent brown mottles. This soil profile differs from the very similar Hummerston soil series in having a prominent Bmgj horizon. Lavenham and Hummerston soils are coarser and more permeable than the finer textured Gateside and Pleasant soils. Lavenham soils were mapped as Black Meadow associates of the Stockton Association in the Carberry (1957) soil report.

Lavinia Series (LAV)

The Lavinia series is characterized by a Gleyed Calcareous Black Chernozem solum, on moderately to strongly calcareous, loamy (L, CL) morainal till of limestone, granite and shale origin. These soils are imperfectly drained and occur in the lower slope positions of undulating to hummocky landscapes, in close association with Varcoe and Moore Park soils. They receive runoff from the upper slopes, and in some landscapes, may be influenced by seepage. Permeability is slow and may be restricted during periods of subsoil saturation.

Lavinia soils differ from the Varcoe series in having a B horizon. They differ from Moore Park soils in having free lime carbonate present in the solum.

Levine Series (LEl)

The Levine series consists of imperfectly drained Gleyed Cumulic Regosol soils, developed on moderately to strongly calcareous, deep, stratified, coarse loamy to fine loamy (VFSL, L, CL) recent alluvial deposits. These soils occur in flood plains on level slopes in level landscapes. They have rapid permeability, moderately slow surface runoff and a medium water table during the growing season. Levine soils are occasionally slightly saline and are subject to periodic inundation during spring runoff or after heavy rains. They have a moderate to low available water holding capacity, low organic matter content and medium natural fertility. The majority of these soils are currently used for crop production.

In a representative profile, the solum is approximately 15 cm thick and the profile is characterized by a dark gray Apk or Ahk horizon, 10 to 20 cm thick, and a light yellowish brown Ckgj horizon. The underlying strata may vary in colour, from light to dark. The thin, dark coloured mineral and organic layers are former surface horizons that have been exposed to soil forming processes for a significant period before burial by alluvial deposits. Medium, distinct yellowish brown iron mottles occur through the soil. Levine soils were previously mapped as inclusions of Eroded Slope Complexes in the reconnaissance soil survey of South-Central Manitoba (1943).

Lindstrom Series (LDM)

The Lindstrom series consists of imperfectly drained, carbonated, Gleyed Rego Black Chernozem soils, developed on a thin mantle (25 to 60 cm) of moderately coarse sediments (VFS, LVFS, FSL), over a thin strata (10 to 50 cm) of very strongly calcareous, loamy glacial till of limestone and granitic origin, over strongly calcareous, glacial till of shale, limestone and granitic origin. Topography is level to very gently sloping. Runoff is moderately slow. Permeability is moderate in the sandy strata and moderately slow in the underlying till.

The soil is characterized by a very dark gray Ah(k) horizon, 18 to 25 cm thick, a dark gray to grayish brown ACgj horizon, 10 to 18 cm thick, and a lime accumulation horizon (Ccagj), six to 10 cm thick. Where the sandy stratum is shallow, the lime accumulation layer grades to the very strongly calcareous, glacial till. A few yellowish brown mottles may be present in the ACgj and Ccagj horizons.

Lockhart Series (LKH)

The Lockhart series consists of moderately well to well drained, Orthic Black Chernozem soils, developed on a thin mantle (25 to 60 cm) of moderately coarse sediments (VFS, LVFS, FSL), over a thin strata (10 to 50 cm) of very strongly calcareous, loamy glacial till of limestone and granitic origin, over a strongly calcareous, loam to clay loam glacial till of shale, limestone, and granitic origin. These soils occur on gently sloping to undulating topography. Runoff is moderate to moderately rapid. Permeability is moderately rapid in the upper sandy strata and moderately slow in the underlying till. These soils have been slightly eroded.

The soil is characterized by a very dark gray Ah horizon, 18 to 25 cm thick, and a grayish brown to brown Bm horizon, 12 to 20 cm thick. The depth of solum varies with the depth of the sandy overlay, with the BC terminating at the contact of the sandy surface and very strongly calcareous till.

Lowton Series (LWN)

The Lowton series consists of poorly drained Rego Humic Gleysol soils, developed on moderately to strongly calcareous, clayey (SiC, C), lacustrine deposits. These soils occur in lower to depressional positions of nearly level landscapes and have very slow permeability, very slow surface runoff, and a high water table during the growing season. Lowton soils are non-eroded, non-stony, and moderately saline. They have a high available water holding capacity, high organic matter content, and low natural fertility. Native vegetation includes native grasses, willows and sedges. The majority of these soils are currently under native vegetation.

In a representative profile, the solum is approximately 20 cm thick. The profile is characterized by moderately decomposed LFH horizon, one to five cm thick, a very dark gray Ahk horizon, five to 20 cm thick with carbonates, and a dark gray to olive gray Ckg horizon, with many mottles and carbonate concentrations. A typical profile also contains till at one to 2.5 m below the surface. Lowton soils occur in close association with Sigmund and Janick soils. They are similar to Landseer soils by having a Rego Humic Gleysol profile developed in clayey sediments, but differ from them in having uniform textures throughout, while Landseer soils are stratified at depth. Lowton soils were previously mapped as minor inclusions of the Oliver Association in the South-Central Manitoba (1943) reconnaissance soil survey.

Mansfield Series (MFI)

The Mansfield series consists of imperfectly drained Gleyed Rego Black Chernozem soils, developed on moderately to strongly calcareous, stratified, deep, sandy skeletal (S, GrS, CoS), glaciofluvial deposits. These soils occur in middle positions of nearly level landscapes and have rapid permeability, moderately slow surface runoff, and a high water table during the growing season. Mansfield soils are non-eroded, non-stony, and non-saline. They have a low available water holding capacity, medium organic matter content, and low natural fertility. Native vegetation includes prairie grasses, shrubs, aspen and bur oak. The majority of these soils are currently used for grazing or forage crops.

In a representative profile, the solum is approximately 20 cm thick. The profile is characterized by a very dark gray Ah horizon, 15 to 25 cm thick, a dark gray to grayish brown ACk horizon, eight to 15 cm thick, moderately calcareous, a Ccagj horizon, five to 8 cm thick, and a Ckgj horizon, with distinct yellowish brown mottles.

Mansfield soils occur in close association with Dorset and Fortina soils. They are similar to Dexter soils by having an imperfectly drained profile in sandy skeletal deposits, but differ from them in having no Bm horizon. Mansfield soils were mapped as associates of the Marringhurst and Agassiz Associations in the South-Central Manitoba (1943) and Carberry (1957) soil reports.

The Mansfield series shaly variant, MFI1, occurs in close association with Mansfield soils. It differs from them in having varying amounts of shaly fragments throughout its profile.

Marringhurst Series (MRH)

The Marringhurst series consists of moderately well to well drained, Calcareous Black Chernozem soils, developed on moderately strongly to strongly calcareous, stratified, deep, sandy (CoS, S, LS) and sandy skeletal (GrS, GrCoS) glaciofluvial deposits. These soils occur in upper positions of very gentle slopes on rolling to irregular landscapes and have very rapid permeability, low surface runoff, and a low water table during the growing season. Marringhurst soils are often moderately eroded, non-stony, and non-saline. They have a low available water holding capacity, low organic matter content, and low natural fertility. Native vegetation includes shrubs, bur oak, and prairie grasses. The majority of these soils are currently excavated for gravel or used for grazing.

In a representative profile soil, the solum is approximately 25 cm thick. The profile is characterized by a very dark gray to very dark grayish brown Ah horizon, 14 to 18 cm thick, a dark brown to brown Bmk horizon, 10 to 18 cm thick, a Cca horizon, 20 to 30 cm thick, with coarser gravelly strata and a Ck horizon.

The Marringhurst, shale gravel variant, MRH1, occurs in close association with normal Marringhurst soils. It differs by having a dominantly shale derived gravel. Marringhurst soils occur in close association with Dorset, Dexter and Fortina soils. They are similar to Dorset soils by having a well drained profile in sandy skeletal deposits, but differ from them in having a Bmk rather than Bm horizon. Marringhurst soils were mapped as the dominant associate of the Marringhurst in the Carberry (1957) soil report.

Marsden Series (MDN)

The Marsden series consists of poorly drained Rego Humic Gleysol, carbonated soils, developed on a sequence of strata consisting of a thin lacustrine mantle (25 to 60 cm) of moderately to strongly calcareous, loamy sediments (VFSL to SiCL), over thin (10 to 40 cm) to medium sand to gravel strata, over strongly calcareous, loam to clay loam glacial till of shale, limestone and granitic origin. The topography is level to depressional. Runoff is negligible, and permeability is restricted during periods when free water is at or near the surface.

The soils are characterized by a thin, moderately decomposed organic layer, one to four cm thick, a very dark gray Ah horizon, 12 to 18 cm thick, and an olive brown ACg, frequently developed in the sand strata. The Ckg horizon is olive gray, with many prominent mottles, and usually occurs at the till contact. Marsden soils were previously mapped as minor associates of the Heaslip complex in the Reconnaissance soil survey of South-Central Manitoba (1943).

Melland Series (MXT)

The Melland series consists of the imperfectly drained, Gleyed Rego Black Chernozem, carbonated soils, developed on a sequence of materials consisting of a thin mantle (25 to 60 cm) of moderately to strongly calcareous, loamy (VFSL to SiCL) sediment, over a thin (10 to 40 cm) layer of medium sand to gravel strata, over strongly calcareous, loam to clay loam glacial till of shale, limestone, and granitic origin. Topography is level to gently sloping. Runoff is moderately slow. Permeability is moderate in the upper strata, but restricted above the till, due to perched water conditions. Lateral flow of water occurs through the gravel strata during the spring, or following heavy rains.

The soil is characterized by a very dark gray Ah horizon, 18 to 25 cm thick, and a dark gray to grayish brown AC horizon, 10 to 15 cm thick. A lime accumulation (Ccagj) horizon is usually present at the transition from loamy to gravel strata. Melland soils are more permeable than the very similar, finer textured Beresford series.

Miniota Series (MXI)

The Miniota series consists of moderately well to well drained, Orthic Black Chernozem soils, developed on a thin mantle (<1 m) of moderately to strongly calcareous, very fine sand to fine sandy loam textured sediments, over moderately to strongly calcareous, medium sand to gravelly textured deposits. The topography varies from gently sloping to irregular, moderately rolling. Runoff is moderate to moderately rapid, and permeability is rapid in the sandy strata and very rapid in the lower coarser strata. They occur in close association with the imperfectly drained Wytonville and Kilmury soils and the poorly drained Bornett series.

The soil is characterized by a very dark gray to very dark grayish brown Ah horizon, 12 to 20 cm thick, a dark brown to brown Bm horizon, 10 to 18 cm thick, and a pale brown BC horizon. The depth of solum varies with the depth of the sandy strata. The lime accumulation (Cca) horizon usually occurs at the transition from sandy to coarser sediments. Miniota soils are less permeable and less droughty than the very similar coarser textured Wheatland and Dorset soils. The similar, finer textured Croyon soils are less droughty.

Moore Park Series (MPK)

The Moore Park series is characterized by a Gleyed Black Chernozem (carbonated) solum on moderately to strongly calcareous, loamy (L, CL) morainal till of limestone, granite and shale origin. These soils are imperfectly drained and occur in the lower slope positions of undulating to hummocky landscapes, in close association with Varcoe soils. They receive runoff from the upper slopes, and in some landscapes, may be influenced by seepage. Permeability is slow and may be restricted during

periods of subsoil saturation.

Newdale Series (NDL)

The Newdale series is characterized by an Orthic Black Chernozem solum on moderately to strongly calcareous, fine loamy (L, SCL, CL) morainal till of limestone, granitic and shale origin. These soils are moderately well to well drained, and occur in mid to upper slope positions of undulating to hummocky landscapes. Surface runoff is moderate to moderately rapid. Permeability is moderately slow. Most of these soils are presently cultivated. They have formed under intermixed aspen grove and grassland vegetation.

The Newdale solum has a very dark gray Ap or Ah horizon, commonly 25 cm thick and ranging from 15 to 35 cm, a dark brown Bm horizon, 10 to 30 cm thick, and a transitional BC horizon, three to 15 cm thick. A lime carbonate horizon, 10 to 15 cm thick, is often present in shallower soils, but is not evident in deeper profiles. Its solum depth averages 58 cm and ranges from 25 to 90 cm. Minor amounts of well drained, Eluviated Black Chernozem soils are included within the Newdale mapping units. They have solum thickness, ranging from 75 cm to greater than one metre. They also have thicker A (combined Ah, Ahe) horizons, 30 to 60 cm, and Bt horizons that are 40 cm thick.

The Newdale soils differ from Erickson soils in being less strongly leached and having less distinct and shallower solum. Newdale soils, on the other hand, differ from the very similar Rufford and Cordova soils in being more strongly leached, deeper and free of lime carbonate in the A and B horizons.

Oberon Series (OBR)

The Oberon series consists of imperfectly drained Gleyed Black Chernozem soils, developed on a thin mantle (<1 m) of strongly calcareous, clay loam to sandy clay loam sediments, grading to moderately calcareous, sandy (FS, LFS, LS) deposits. They occur on level to gently sloping topography. Runoff is moderate to moderately slow. Permeability is moderate in the upper loamy strata and moderately rapid in the sandy subsoil, when not restricted by a high water table in early spring or summer.

The soil is characterized by a very dark gray Ah horizon, 18 to 25 cm thick, a subangular blocky brown to olive brown Bmgj horizon, 12 to 22 cm thick with yellowish brown mottles in the lower part of the horizon, and a BCgj horizon, eight to 16 cm thick. Carbonate accumulation (Ccagj horizon) is usually present within the loamy strata. The sandy substrata is light yellowish brown, with yellowish brown to strong brown mottles of iron.

The Oberon, clayey variant, OBR1, differs from the modal Oberon by having a silty clay to clay textured layer, 10 to 40 cm thick, often forming part of the Bmgj horizon.

Penrith Series (PEN)

The Penrith series is a Humic Luvic Gleysol solum, developed on moderately to strongly calcareous, loamy (L, CL), morainal till of limestone, granitic and shale rock origin. These soils are poorly drained and occur in depressional positions of undulating to hummocky landscapes. These soils are ponded for a variable period in the spring and early summer. They usually are free of water in the summer and fall, unless replenished by heavy rains and runoff. Permeability is very slow within the solum and moderately slow in the subsoil. Vegetation consists of sedge and ringed with willow.

The solum of the Penrith series commonly has a moderately to strongly decomposed organic layer, four to eight cm thick, a dark gray to gray Ahe horizon, six to 10 cm thick, a light gray, platy Aeg horizon, six to 10 cm thick, a dark gray to gray Btg horizon, 35 to 45 cm thick, and a gray transitional BCg, 15 to 25 cm thick. The A horizon thickness averages 22 cm and ranges from five to 45 cm. The average solum depth is 77 cm and ranges from 30 to 105 cm. These soils differ from the Drokan soils in being more strongly leached, and having more distinct and thicker horizons.

Perillo Series (PER)

The Perillo series consists of very poorly drained Terric Mesisol soils, developed on a mantle (40 to 160 cm) of moderately decomposed organic, material composed of fen peat, over moderately to strongly calcareous, deep, uniform, coarse loamy (LFS, FS), lacustrine deposits. These soils occur in depressional positions on rolling to hummocky landscapes and have slow permeability, very slow surface runoff and a very high water table during the growing season. Perillo soils are occasionally slightly saline. They have a high available water holding capacity, very high organic matter content, and low natural fertility. Native vegetation often includes sedges, reeds, and clumps of willow or swamp birch. The majority of these soils are currently used for natural grazing.

In a representative profile, the solum is approximately 50 cm thick. The profile is characterized by a black Om horizon, five to 15 cm thick, a black Oh horizon, 20 to 45 cm thick, a black Ahgj horizon, 15 to 25 cm thick, with a few large iron mottles, and a light brownish gray ACg horizon, 10 to 25 cm thick, with many large prominent iron mottles. The mineral soil parent material is typically light gray in colour, with numerous prominent mottles and manganese concretions. A typical profile also contains snail shells on the surface and throughout the profile.

Perillo soils occur in association with sloughs, lakes and areas of restricted drainage. They are similar to Tadpole peaty phase soils, but differ from them in having an organic surface horizon greater than 40 cm thick to the mineral soil substrate. Perillo soils were previously mapped as meadow or marsh inclusions of many soil associates in the reconnaissance soil survey of South-Central Manitoba (1943).

Petrel Series (PTR)

The Petrel series consists of imperfectly drained Gleyed Black Chernozem soils, developed on a mantle (25 to 75 cm) of moderately to strongly calcareous, shallow, medium textured (VFSL, L, SiL), deposits, over moderately calcareous, uniform, deep, moderately coarse (FS, LFS, LS), lacustrine deposits. These soils occur in middle positions of very gentle slopes on undulating landscapes and have moderate over moderately rapid permeability, moderately slow surface runoff, and a high water table during the growing season. Petrel soils are non-eroded, non-stony, and occasionally slightly saline. They have a medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes prairie grasses, shrubs, aspen and oak. The majority of these soils are currently cultivated for crop production.

In a representative profile, the solum is approximately 40 cm thick. The profile is characterized by a very dark gray Ap or Ah horizon, 18 to 25 cm thick, a brown Bm horizon, 14 to 20 cm thick, a BCgj horizon, 20 to 30 cm thick with faint mottles and a light yellowish brown Ckgj horizon, with yellowish brown to strong brown mottles. A typical profile also contains a weak Ccagj in the upper part of the sandy substrate.

The PTR1 variant differs from the modal Petrel by having a layer of CL, SICL sediments overlying the sandy materials.

Petrel soils occur in close association with Glenboro, Grover and Grayson soils. They are similar to Torcan soils by having imperfect drainage and a loamy surface, but differ from them in having a sandy substrate. Petrel soils were previously mapped as Black Meadow associates of the Glenboro Association in the Carberry (1957) soil report.

Pleasant Series (PLE)

The Pleasant series consists of imperfectly drained Gleyed Rego Black Chernozem soils, developed on moderately to strongly calcareous, deep, uniform, moderately coarse (VFS, LVFS, FSL), lacustrine

deposits. These soils occur in middle positions of irregular to undulating landscapes and have moderate permeability, moderately slow surface runoff, and a high water table during the growing season. Pleasant soils are non-eroded, non-stony, and frequently slightly saline. They have a medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes tall prairie grasses, prairie-meadow grasses, shrubs and aspen-oak groves. The majority of these soils are currently cultivated for crop production.

In a representative profile, the solum is approximately 20 cm thick. The profile is characterized by a very dark gray Ap or Ah horizon, 15 to 25 cm thick, a dark grayish brown AC horizon, six to 10 cm thick, a Ccagj horizon, 10 to 15 cm thick, and a light olive brown Ckgj horizon, with yellowish brown mottles. A typical profile also contains gypsum crystals below the Ccagj horizon.

Pleasant soils occur in close association with Prosser, Gateside and Poolex soils. They are similar to Taggart soils by having an imperfectly drained Gleyed Rego Black Chernozem profile, but differ from them in having coarse loamy, rather than loamy deposits. Pleasant soils were previously mapped as Black Meadow associates of the Holland Association in the Carberry (1957) soil report.

Poolex Series (POX)

The Poolex series consists of poorly drained Rego Humic Gleysol soils, developed on moderately to strongly calcareous, deep, uniform, coarse loamy (VFS, LVFS, FSL, SL) lacustrine deposits. These soils occur in level to depressional positions on undulating landscapes, and have moderate permeability, slow surface runoff, and a high to ponded water table during the growing season. Poolex soils are non-eroded, non-stony, and often slightly saline. They have a medium available water holding capacity, medium organic matter content, and low natural fertility. Native vegetation includes sedges, rushes, seeds and willows. The majority of these soils are currently in native vegetation.

In a representative profile, the solum is approximately 20 cm thick. The profile is characterized by a moderately decomposed organic horizon, one to four cm thick, a very dark gray Ah horizon, 15 to 22 cm thick, an olive gray to gray AC horizon, six to 12 cm thick, moderately calcareous, and a Ccag horizon, 10 to 15 cm thick. The parent material is typically olive brown to pale olive, with yellowish brown mottles.

Poolex soils occur in close association with Porple, Pleasant and Gateside soils. They are similar to Vordas soils by having a poorly drained profile in loamy deposits, but differ from them by having slightly coarser textures. Poolex soils were previously mapped as Meadow associates of the Poolex Association in the Carberry (1957) soil report.

Porple Series (POR)

The Porple series is a Rego Black Chernozem soil, developed on moderately well to well drained, moderately to strongly calcareous, moderately coarse (VFS, LVFS, FSL, SL), lacustrine sediments. These soils occur on the upper slope positions of gently undulating topography associated with Prosser and Pleasant soils. Surface runoff is moderately rapid, and permeability is moderate to moderately rapid. These soils have had some erosion, and are susceptible to both wind or water erosion if not protected. Included with this series are some of the moderately eroded Prosser soils.

The Porple series is characterized by a very dark gray Ap or Ah horizon, 15 to 20 cm thick, and a calcareous, ACk horizon, eight to 15 cm thick. A layer of lime carbonate accumulation (Cca horizon) may be present. This soil differs from the similar Prosser soils in not having a prominent Bm horizon. Porple soils are finer textured and less permeable than the sandy Stockton soils. In turn, they are coarser textured and more permeable than the very similar loamy textured Durnan and Fairland soils.

Prodan Series (PDA)

The Prodan series is a Gleyed Rego Black Chernozem, carbonated soil, developed on imperfectly drained, strongly to very strongly calcareous, moderately fine (SCL, CL, SiCL), lacustrine sediments. These soils occur in the Upper Assiniboine Delta and Brandon Lakes Plain on gently sloping topography, in association with Ramada, Charman, Carroll and Tadpole soils. Surface runoff is moderately slow, and permeability is moderate to moderately slow. A seasonal water table frequently occurs within 70 cm of the surface.

The Prodan soil profile has a very dark gray Ah horizon, 18 to 25 cm thick, a dark gray to gray AC horizon, eight to 15 cm thick, and a Ccagj horizon. The Ckgj horizon is light brownish gray, with yellowish brown mottles. This soil differs from the similar Charman series in not having a prominent Bmgj horizon. Prodan soils are finer textured and less permeable than the similar loamy textured Taggart and Torcan soils. The very similar Capell soils have coarse, sandy and gravelly textured subsoils that are very rapidly permeable. Prodan soils were previously mapped as Black Meadow associates of the Holland Association in the reconnaissance soil survey of South-Central Manitoba (1943).

Prosser Series (PSE)

The Prosser series is an Orthic Black Chernozem soil, developed on moderately well to well drained, moderately to strongly calcareous, coarse loamy (VFS, LVFS, FSL, SL), lacustrine sediments. These soils occur in the Upper Assiniboine Delta and Brandon Lakes Plain in association with Porple, Gateside, Pleasant and Poolex soils, on mid and upper slopes of undulating to gently rolling topography. Surface runoff is moderate to rapid, and permeability is moderate to moderately rapid.

The Prosser soil profile has a very dark gray Ah horizon, 18 to 25 cm thick, a dark brown to brown Bm horizon, 12 to 20 cm thick, a pale brown BCk horizon, and usually a Cca horizon, 12 to 18 cm thick. This soil differs from the similar Porple series in having a prominent Bm horizon. The coarse loamy Prosser soils are somewhat finer textured and less permeable than the sandy Stockton and Cactus soils. In turn, they are coarser textured and more permeable than the similar loamy textured Fairland and Durnan soils.

The Prosser, fine loamy variant, PSE1, is found in association with the normal Prosser soils. It differs from the normal Prosser by having a finer textured (clay loam to silty clay loam) soil, at or within a one-metre depth.

Ramada Series (RAM)

The Ramada series is an Orthic Black Chernozem soil, developed on well to moderately well drained, strongly to very strongly calcareous, moderately fine (CL, SiCL, SCL), lacustrine sediments. These soils occur in the Upper Assiniboine Delta, and Brandon Lakes Plain on very gently sloping topography, or on mid and upper slope positions of undulating topography associated with Barren, Carroll, Charman, Prodan and Tadpole soils. Surface runoff is moderately rapid, and permeability is moderate to moderately slow.

The Ramada soil profile has a very dark gray Ap or Ah horizon, 10 to 20 cm thick, a dark grayish brown to brown Bm horizon, eight to 12 cm thick, and a BC horizon, six to 10 cm thick. A Cca horizon is usually present. The Ck horizon is pale brown to light yellowish brown. This soil differs slightly from the Carroll soil in having a prominent Bm horizon. Ramada soils are finer textured and less permeable than the similar coarser textured, loamy Fairland soils, as well as the Croyon and Zarnet soils, which have coarse sandy and gravelly textured subsurface layers and very rapid permeability. Ramada soils were previously mapped as the dominant associate of the Holland Association in the reconnaissance soil survey of South-Central Manitoba (1943).

Rempel Series (RMP)

The Rempel series consists of moderately well to well drained, Calcareous Black Chernozem soils, developed on strongly to very strongly calcareous, deep, uniform, moderately fine (CL, SiCL, SCL), lacustrine deposits. These soils occur in upper positions of undulating landscapes and have moderate permeability, moderately rapid surface runoff, and a low water table during the growing season. Rempel soils are occasionally slightly eroded, non-stony, and non-saline. They have a medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation includes tall prairie grasses, meadow grasses and aspen-oak groves. The majority of these soils are cultivated for crop production.

In a representative profile, the solum is approximately 20 cm thick. The profile has a weakly calcareous, very dark gray to very dark grayish brown Ap or Ah horizon, 15 to 22 cm thick, a dark grayish brown to brown Bmk horizon, 10 to 15 cm thick, a pale brown BCk horizon, five to 10 cm thick, moderately calcareous, and a light gray to white Cca horizon, 10 to 15 cm thick. Rempel soils occur in close association with Ramada, Prodan and Tadpole soils. They are similar to Ramada soils by having well drained, fine loamy soils, but differ from them in having a Bmk rather than Bm horizon. Rempel soils were previously mapped as Blackearth associate of the Holland Association in the Carberry (1957) soil report.

Rufford Series (RUF)

The Rufford series is characterized by a Rego Black Chernozem solum on moderately to strongly calcareous, fine loamy (L, CL, SCL) morainal till of limestone, granite and shale origin. These soils are moderately well to well drained, and occur on the upper slopes and knoll positions in undulating to hummocky landscapes, in close association with Cordova and Newdale soils. Runoff is moderately rapid to rapid. Permeability is moderately slow.

Rufford profiles have a very dark gray to very dark grayish brown Ap or Ah horizon, 12 to 18 cm thick and a thin ACk horizon, six to 10 cm thick. A carbonate accumulation (Cca) layer, five to 15 cm thick, is usually present. In the Russell area, the A horizon averages 28 cm and ranges from 10 to 50 cm. The solum depth averages 37 cm and ranges from 20 to 55 cm. Rufford soils differ from Cordova soils in being less leached and having thinner, less distinct horizons. Both Rufford and Cordova differ from Newdale in being less leached and having free lime carbonate in their A and B horizons.

Shilox Series (SHX)

The Shilox series consists of moderately well to excessively drained Orthic Regosol soils, developed on weakly to noncalcareous, deep, uniform, sandy (FS, LS, S), eolian deposits. These soils occur in middle and upper positions of moderate to strong slopes on hummocky to duned landscapes, and have rapid to very rapid permeability, minimal surface runoff, and a low water table during the growing season. Shilox soils are severely wind eroded, non-stony, and non-saline. They have low available water holding capacity, low organic matter content, and low natural fertility. Native vegetation includes oak, black spruce, juniper and prairie grasses. The majority of these soils are currently wooded.

In a representative profile, the solum is not developed. The profile is characterized by a partially decomposed LH horizon, one to two cm thick, a grayish brown to pale brown Ah horizon, six to 10 cm thick, and a light yellowish brown to pale brown C horizon. A typical profile also contains an occasional buried Ah horizon, two to four cm thick.

Shilox soils occur in close association with Onahan and Mockry soils. They are similar to Arizona soils by having a Regosol profile in sandy deposits, but differ from them in having less stratification and more uniform textures. Shilox soils were previously mapped as duned associates of the Stockton Association in the Carberry (1957) soil report.

Sigmund Series (SGO)

The Sigmund series consists of imperfectly drained, Gleyed Rego Black Chernozem soils, developed on moderately to strongly calcareous, deep, uniform clayey (SiC, C), lacustrine deposits. These soils occur in lower slope positions of very gentle slopes on undulating landscapes, and have slow permeability, moderately slow surface runoff, and a high water table during the growing season. Sigmund soils are non-eroded, non-stony, and frequently slightly saline. They have high available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes aspen-oak groves, willow and prairie grasses. The majority of these soils are currently annual crop production.

In a representative profile, the solum is approximately 20 cm thick. The profile is characterized by a very dark gray Ap or Ah horizon, 15 to 25 cm thick, a dark gray ACgj horizon, five to 18 cm thick, with many faint mottles, a light gray Ccagj horizon, five to 15 cm thick, with many prominent mottles and a light olive brown Ckgj horizon, with many prominent mottles. A typical profile also contains gypsum crystals in the subsoil.

Sigmund soils occur in close association with Janick, Harding and Lowton soils. They are similar to Harding soils by having an imperfectly drained profile in clayey deposits, but differ from them by having no B horizon. Sigmund soils were previously mapped as minor inclusions of the Oliver Association in the soil survey of South-Central Manitoba (1943).

Stockton Series (SCK)

The Stockton series is an Orthic Black Chernozem soil, developed on moderately well to well drained, weakly to moderately calcareous, coarse textured (FS, LFS, LS), lacustrine sediments. These soils occur in the Upper Assiniboine Delta, the Brandon Lakes Plain and a few areas within the Lower Assiniboine Delta on very gently sloping to irregular undulating topography, in association with Cactus, Lavenham, Hummerston and Sewell soils. Surface runoff is low, and permeability is rapid. Wind erosion is common, if the soil is not protected with adequate surface residue.

The Stockton soil profile has a very dark gray to very dark grayish brown Ah, 18 to 25 cm thick, a brown to grayish brown Bm horizon, 12 to 22 cm thick, a pale brown to light yellowish brown BC horizon, eight to 12 cm thick, and a very pale brown Ck horizon with a few yellowish brown mottles at approximately 70 cm depth. A Cca horizon is also frequently present. This soil differs from the very similar Cactus series by having a prominent Bm horizon. The sandy Stockton soils are coarser textured and significantly more rapidly permeable than the finer textured Prosser, Fairland and Ramada soils.

The SCK1 variant has a clay loam to silty clay loam substrate and is currently described as the Hallboro series.

Sutton Series (SXP)

The Sutton series consists of poorly drained Rego Humic Gleysol soils, developed on a mantle (25 to 100 cm) of moderately calcareous, moderately fine (SCL, CL, SiCL), lacustrine deposits, over moderately calcareous, deep, stratified, sandy (FS, LFS, LS), fluvial lacustrine deposits. These soils occur in depressional positions on nearly level landscapes and have restricted permeability, negligible surface runoff, and a near surface water table during the growing season. Sutton soils are non-eroded, non-stony, and frequently weakly saline. They have moderate available water holding capacity, high organic matter content, and low natural fertility. Native vegetation includes sedges, hydrophytic grasses and willows. The majority of these soils are currently in native vegetation.

In a representative profile, the solum is approximately 20 cm thick. The profile is characterized by a moderately decomposed organic horizon, two to four cm thick, a very dark gray Ah horizon, 10 to 18 cm thick, a dark gray ACk horizon, four to eight cm thick with carbonates, and a light gray Ccag

horizon, five to eight cm thick, with many distinct mottles. The parent material is typically olive brown in colour, with many prominent mottles. A typical profile also contains gypsum crystals at depth.

Sutton soils occur in close association with Wellwood soils. They are similar to Tadpole soils by having a poorly drained profile and a fine loamy surface, but differ by having a sandy substrate, while Tadpole soils are fine loamy throughout. Sutton soils were previously mapped as poorly drained associates of the Wellwood Association in the soil survey of South-Central Manitoba (1943).

Tadpole Series (TDP)

The Tadpole series is a Rego Humic Gleysol, developed on poorly drained, strongly to very strongly calcareous, moderately fine (SCL, CL, SiCL), lacustrine sediments. These soils occur in level to depressional positions of gently sloping to undulating topography, in association with Carroll, Firdale, Charman and Danlin soils. Surface runoff is very slow and permeability is restricted. Free water occurs at or near the surface for a considerable part of the year. In areas where seepage water contains appreciable soluble salt, a sufficient salt accumulation can occur to inhibit or retard the growth of normal hydrophytic vegetation.

The Tadpole soil profile has a moderately decomposed organic layer, two to six cm thick, a very dark gray Ah horizon, 10 to 18 cm thick, a dark gray AC horizon, four to six cm thick, a Ccag horizon, 10 to 15 cm thick, and an olive to olive gray Ckg horizon with distinct yellowish brown mottles. In areas affected by salts, white pseudomycelia are common in the surface horizons. Tadpole soils are finer textured and less permeable than the very similar and coarser textured Vordas, Poolex and sandy Mockry and Sewell soils. The similar Carvey soils have coarser textured sandy to gravelly subsurface layers that are much more rapidly permeable than the Tadpole soils.

Taggart Series (TGR)

The Taggart series consists of imperfectly drained Gleyed Rego Black Chernozem soils, developed on strongly to very strongly calcareous, deep, uniform, medium textured (VFSL, L, SiL), lacustrine deposits. These soils occur in middle positions of undulating landscapes and have moderate permeability, slow surface runoff, and a high water table during the growing season. Taggart soils are non-eroded, non-stony, and often slightly saline. They have medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes aspen, oak, willow and prairie grasses. The majority of these soils are currently cultivated for crop production.

In a representative profile, the solum is approximately 20 cm thick. The profile is characterized by a very dark gray Ap or Ah horizon, 15 to 24 cm thick, a dark gray ACk horizon, five to 15 cm thick, moderately calcareous, a Cca horizon, eight to 12 cm thick with a carbonate accumulation, and an olive brown Ckgj horizon, with yellowish brown mottles. A typical profile also contains gypsum crystals below the Cca horizon.

Taggart soils occur in close association with Fairland, Durnan and Vordas soils. They are similar to Torcan soils by having imperfect drainage and loamy deposits, but differ from them by having no prominent Bm horizon. Taggart soils were previously mapped as associates of the Holland Association in the Carberry (1957) soil report.

Torcan Series (TOC)

The Torcan series consists of imperfectly drained Gleyed Black Chernozem soils, developed on strongly to very strongly calcareous, deep, uniform, medium textured (VFSL, L, SiL), lacustrine deposits. These soils occur in middle to lower positions of undulating to rolling landscapes and have moderate permeability, moderately slow surface runoff, and a medium water table during the growing season. Torcan soils are non-eroded, non-stony, and occasionally slightly saline. They have medium available water holding capacity, medium organic matter content, and high natural fertility. Native

vegetation includes aspen, willow, shrubs and meadow grasses. The majority of these soils are cultivated for crop production.

In a representative profile, the solum is approximately 45 cm thick. The profile is characterized by a very dark gray Ap or Ah horizon, 18 to 25 cm thick, a light brown Bmgj horizon, 10 to 18 cm thick with yellowish brown mottles, a Ccagj horizon, eight to 12 cm thick, and a light olive brown Ckgj horizon, with yellowish brown mottles. Torcan soils occur in close association with Fairland, Taggart and Vordas soils. They are similar to Taggart soils by having imperfect drainage and loamy deposits, but differ from them by having a prominent Bm horizon. Torcan soils were previously mapped as associates of the Holland Association in the Carberry (1957) soil report.

Traverse Series (TAV)

The Traverse series consists of well to moderately well drained, Calcareous Black Chernozem soils, developed on strongly to very strongly calcareous, deep, uniform, medium textured (VFSL, L, SiL), lacustrine deposits. These soils occur in middle and upper positions of very gentle slopes on undulating landscapes and have moderate permeability, moderate to rapid surface runoff, and a low water table during the growing season. Traverse soils are often slightly eroded, non-stony, and non-saline. They have medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation includes oak, aspen, shrubs and prairie grasses. The majority of these soils are currently cultivated for crop production.

In a representative profile, the solum is approximately 25 cm thick. The profile is characterized by a very dark gray Ap or Ah horizon, 10 to 18 cm thick, a dark grayish brown Bmk horizon, eight to 15 cm thick, moderately calcareous, a brown to pale brown BCk horizon, 10 to 15 cm thick, moderately calcareous, and a white Cca horizon, eight to 12 cm thick with carbonate accumulation. The parent material is typically dark yellowish brown.

Traverse soils occur in close association with Fairland, Taggart and Vordas soils. They are similar to Rempel soils by having a Calcareous Black Chernozem profile, but differ from them by having loamy rather than fine loamy deposits. Traverse soils were mapped as Calcareous Black associates of the Holland Association in the Carberry (1957) soil report.

Varcoe Series (VRC)

The Varcoe series is characterized by a Gleyed Rego Black Chernozem (carbonated) solum on moderately to strongly calcareous, fine loamy (L, CL, SCL) morainal till of limestone, granite and shale origin. These soils are imperfectly drained and occur in the lower slope positions of undulating to hummocky landscapes, in close association with Angusville soils. They receive runoff from the upper slopes, and in some landscapes, may be influenced by seepage. Permeability is slow and may be restricted during periods of subsoil saturation. In areas where upward groundwater or seepage waters contain appreciable salts, accumulation of salts may occur within the soil.

Varcoe profiles average 42 cm in thickness and range from 20 to 60 cm. The Ap or Ah horizon is usually 28 cm thick and ranges from 20 to 50 cm. It is very dark gray in color and is underlain by a dark gray transitional AC horizon, four to eight cm thick. A carbonate accumulation horizon (Ccagj) is commonly present, but may be discontinuous. Gypsum crystals are usually present below and within the carbonate accumulation layer. Varcoe soils containing significant soluble salts in the A horizon, as well as gypsum, have been identified as the saline phase of the series.

Vodroff Series (VFF)

The Vodroff series consists of poorly drained Rego Humic Gleysol soils, developed on a thin mantle (<1 m) of loamy (L, CL, SiCL) lacustrine sediments over a strongly calcareous, loam to clay loam glacial till of shale, limestone and granitic origin. These soils have free water at or near the surface for a considerable period of the year. The topography is level to depressional, runoff is negligible, and permeability is restricted

during periods of free water within a metre. In areas where the inflowing waters contain appreciable soluble salts, the salt may accumulate in the soil in sufficient amount to affect the growth of normal hydrophytic vegetation.

The soil is characterized by a moderately decomposed organic layer, two to five cm thick, a very dark gray Ah horizon, 10 to 18 cm thick, a mottled dark gray ACg horizon, four to eight cm thick, and a carbonate accumulation horizon, eight to 12 cm thick. The Ckg horizon is olive to pale olive and usually contains yellowish brown mottles.

Vordas Series (VDS)

The Vordas series consists of poorly drained Rego Humic Gleysol soils, developed on strongly to very strongly calcareous, deep, uniform, medium textured (VFSL, SiL, L), lacustrine deposits. These soils occur in level to depressional positions of undulating landscapes. They have moderate permeability, very slow surface runoff, and a high to ponded water table during the growing season. Vordas soils are non-eroded, non-stony, and often slightly saline. They have medium available water holding capacity, high organic matter content, and low natural fertility. Native vegetation includes sedges, rushes, reeds and willows. The majority of these soils are currently in native vegetation.

In a representative profile, the solum is approximately 15 cm thick. The profile is characterized by a moderately decomposed organic horizon, two to five cm thick, a very dark gray Ah horizon, 10 to 18 cm thick, a dark gray ACkg horizon, four to six cm thick with carbonates and mottles, and an olive to pale olive Ckg horizon, with yellowish brown iron mottles. A typical profile also contains white pseudomycelia of salt in the Ah and ACkg horizons in saline areas.

Vordas soils occur in close association with Fairland, Taggart and Torcan soils. They are similar to Tadpole soils by having poor drainage and loamy deposits, but differ from them by having slightly coarser textures. Vordas soils were previously mapped as Meadow associates of the Holland Association in the Carberry (1957) soil report.

Wellwood Series (WWD)

The Wellwood series consists of well to moderately well drained, Orthic Black Chernozem soils, developed on a thin mantle (25 to 75 cm) of strongly calcareous, fine loamy (CL, SCL, SiCL) sediments, grading to moderately calcareous, sandy (FS, LS, LFS) deposits. Topography is nearly level to very gently sloping. Runoff is moderate to moderately slow. Permeability is moderate in the upper loamy strata and rapid in the sandy strata.

The soil is characterized by a deep black to very dark gray, loam to clay loam, Ah horizon, 18 to 30 cm thick, a dark brown to brown, prismatic to subangular blocky, clay loam to silty clay, Bm horizon, 16 to 24 cm thick, and a yellowish brown to pale brown, clay loam to silty clay loam, BC horizon, eight to 14 cm thick. A Cca horizon may be present, underlain by a II Ck that ranges from fine sand to loamy fine sand.

The Wellwood, clay variant, WWD1, differs from the modal Wellwood by having a clay to silty clay textured layer, 10 to 40 cm thick within the solum that often forms part of the Bm horizon. The underlying sandy sediments usually occur at a greater depth than in the modal Wellwood.

Wheatland Series (WHL)

The Wheatland series consists of well to moderately well drained, Orthic Black Chernozem soils, developed on a mantle (60 to 95 cm) of moderately to strongly calcareous, shallow sandy (FS, LS), deposits over moderately to strongly calcareous, deep, stratified, sandy-ske letal (CoS, MS), fluvial deposits. These soils occur in upper positions of gentle to very gentle slopes on undulating landscapes, and have rapid, over very rapid, permeability, moderately slow surface runoff, and a low water table during the growing season. Wheatland soils are occasionally slightly eroded, non-stony, and non-saline. They have low available water holding capacity, medium organic matter content, and low natural fertility. Native vegetation includes oak, aspen, shrubs and prairie grasses. The majority of these soils are currently used for grazing and for some crop production.

In a representative profile, the solum is approximately 40 cm thick. The profile is characterized by very dark gray to very dark grayish brown Ap or Ah horizon, 18 to 25 cm thick, a brown to yellowish brown Bm horizon, 12 to 24 cm thick, a light yellowish brown BCk horizon, 10 to 15 cm thick with carbonates, and a Cca horizon, five to eight cm thick at the sand/gravel contact. They are similar to Dorset soils by having an Orthic Black Chernozem profile and sandy-skeletal substrate, but differ from them in having a sandy surface mantle. Wheatland soils were previously mapped as associates of the Agassiz Association in the Carberry (1957) soil report.

Woodfield (WDF)

The Woodfield series consists of moderately well to well drained, Calcareous Black Chernozem soils, developed on stony, very strongly to extremely calcareous loamy glacial drift of limestone and granitic origin. Some coarser materials may occur at variable depths. These soils occur on the mid and upper slopes of irregular undulating to moderately rolling topography of the Brandon Hills. They are more common on the south and west facing slopes, which receive greater amounts of radiation per area, resulting in a greater moisture deficiency than Stanley soils on north and east slopes. Runoff is moderately rapid to rapid, and permeability is moderate.

The soil is characterized by a very dark gray Ap or Ah horizon, 10 to 15 cm thick, and a calcareous, dark grayish brown to brown Bmk horizon, eight to 12 cm thick. A white lime accumulation (Cca) horizon is common below the solum, but is often difficult to differentiate from the very strongly calcareous till. The cultivated soils are susceptible to wind and water erosion and have had some of the Ah horizon removed.

Wytonville Series (WVI)

The Wytonville series consists of imperfectly drained Gleyed Black Chernozem soils, developed on a thin mantle (<1 m) of moderately to strongly calcareous, coarse loamy (VFS, LVFS, SL, FSL) sediments, overlying moderately to strongly calcareous, medium sand to gravelly textured deposits. Topography is gently sloping to irregular or undulating. Runoff is moderately slow. Permeability is moderately rapid on the upper strata, and very rapid in the lower strata, unless restricted by a water table within a metre of the surface during the spring or following heavy rains.

The soil is characterized by a very dark gray to very dark grayish brown Ah horizon, 18 to 25 cm thick, a brown to dark brown, weakly mottled Bmgj horizon, 14 to 22 cm thick and a light yellowish brown BCgj with strong brown mottles. A carbonate accumulation horizon (Ccagj) occurs at the upper boundary of the coarse strata. Wytonville profiles differ from Kilmury soil profiles in not having the presence of carbonates in their Ah. They are also more permeable than the very similar Druxman soils. They occur in close association with the Kilmury soils, the well drained Miniota soils and the poorly drained Bornett series.

Xavier Series (XVI)

The Xavier series consists of very poorly drained, Typic Mesisol soils, developed on deep (>160 cm), moderately decomposed, mesic fen peat deposits. These soils occur in depressional positions of undulating landscapes and have moderately slow permeability, very slow surface runoff, and a high to ponded water table during the growing season. Xavier soils are non-eroded, non-stony, and non-saline. They have a high available water holding capacity, high organic matter content, and medium natural fertility. Native vegetation includes sedges, rushes, reeds and willow. The majority of these soils are currently in native vegetation.

Xavier soil is characterized by a dark yellowish brown of horizon, 10 to 30 cm thick, which is medium acid to neutral and a thick, very dark brown, medium acid to neutral Om horizon, grading into a black, weakly acid to weakly calcareous, Oh horizon. Underlying mineral strata range in texture from loam to clay. Xavier soils are similar to Perillo soils by having very poor drainage and organic deposits. They differ from them in having deep (>160 cm) rather than shallow (40-160 cm) organic deposits.

Zarnet Series (ZRT)

The Zarnet series is a Rego Black Chernozem soil, developed on moderately well to well drained,

moderately to strongly calcareous, loamy (VFSL, L, SiL, CL, SiCL) lacustrine sediments less than one metre in depth, overlying moderately to strongly calcareous, sandy (S, CoS) to sandy skeletal (GrS, GrCoS) fluvial deposits. The soils occur on gently sloping topography, or in upper slope and knoll positions of irregular, undulating to gently rolling topography. Surface runoff is moderate to rapid, dependent upon the gradient with moderate permeability in the upper sediments, as opposed to rapid permeability in the lower deposits.

The Zarnet soil profile is characterized by a very dark gray Ah horizon, 12 to 18 cm thick, a dark gray to dark grayish brown AC horizon, eight to 14 cm thick, and a carbonate accumulation horizon (Cca) of 10 to 18 cm thickness. Zarnet soil profiles are shallower and lack Bm horizons that characterize Croyon soils, a closely-related associate.

Appendix 3 Glossary

AASHO classification (soil engineering) - The official classification of soil materials and soil aggregate mixtures for highway construction used by the American Association of State Highway Officials.

Acid soil - A soil having a pH less than seven. See pH and Reaction, soil.

Alkali soil - (i) A soil having a high degree of alkalinity (pH of 8.5 or higher), or having a high exchangeable sodium content (15% or more of the exchangeable capacity), or both**.** (ii) A soil that contains enough alkali (sodium) to interfere with the growth of most crop plants.

Alkaline soil - A soil having a pH greater than seven. See pH and Reaction, soil.

Alluvium - A general term for all deposits of rivers and streams. Sediments can be different sizes depending upon the location in the floodplain of the river.

Arable soil - Soil suitable for plowing and cultivation.

Association - A sequence of soils of about the same age, derived from similar parent material, and occurring under similar climatic conditions, but showing different characteristics due to variations in relief and in drainage.

1/3 Atmosphere Moisture - The moisture percentage on dry weight basis of a soil sample that has been air dried, screened, saturated and subjected to a soil moisture tension of 345 cm of water through a permeable membrane for a period of 48 hours. It approximates the soil moisture at field capacity for loam textured soils.

Atterberg limits - See **liquid limit** and **plastic limit**.

Available nutrient - The portion of any element or compound in the soil that can be readily absorbed and assimilated by growing plants.

Available water - The portion of water in a soil that can be readily absorbed by plant roots. It is generally considered to be that water held in the soil against a pressure of up to approximately 15 atmospheres. See also **field capacity** and **wilting point**.

Bearing capacity - Capacity of soil (in moist to wet conditions) to support loads such as buildings, people, vehicles, and animals. The average load per unit area that is required to rupture a supporting soil mass.

Bedrock - The solid rock that underlies soil and the regolith or that is exposed at the surface.

Blocky structure - Aggregates arranged with faces rectangular and flattened, vertices sharply angular.

Bog - A peat-covered or peat-filled area, generally nutrient-poor, in which mosses and especially sphagnum are dominant. The water table is at the surface for most of the year.

Boulders - Rock fragments larger than 60 cm (two ft) in diameter.

Brunisolic - An order of soils whose horizons are developed sufficiently to exclude the soils from the Regosolic order, but lack the degrees or kinds of horizon development specified for soils of the other orders.

Bulk density - The weight of oven dry soil (105 degrees C) divided by its volume at field moisture conditions, expressed in grams per cubic centimetre.

Buried soil - Soil covered by an alluvial, loessial, or other deposit, usually to a depth greater than the thickness of the solum.

Calcareous soil - Soil containing sufficient calcium carbonate (often with magnesium carbonate) to effervesce visibly when treated with (1N) hydrochloric acid.

Calcium Carbonate Equivalent - Refers to the per cent of carbonates in the soil, expressed on the basis of calcium carbonate. Terms used to express the carbonate contents of soils are:

non-calcareous. . . . . .< 1%
weakly calcareous. . . . . one to five per cent
moderately calcareous. . . . . six to 15%

strongly calcareous. . . . . .16 to 25%
very strongly calcareous . . . . 26 to 40%
extremely calcareous . . . . . .> 40%

Capillary fringe - A zone of essentially saturated soil just above the water table. The size distribution of the pores determines the extent and degree of the capillary fringe.

Carbon-nitrogen ratio (C/N ratio) -The ratio of the weight of organic carbon to the weight of total nitrogen in a soil or in an organic material.

Cation Exchange Capacity (CEC) - A measure of the total amount of exchangeable cations that can be held by a soil. It is expressed in milliequivalents per 100 g of soil.

Channery - A descriptive term used for thin and flat limestone, sandstone, or schist fragments up to 15 cm (six inches) in length.

Chernozemic - An order of soils that have developed under grassland or grassland-forest transition vegetation, in cool to cold, subarid to subhumid climates. The soils have a dark-colored surface horizon and a B or C horizon, or both, of high base saturation.

Clay - As a soil separate, the mineral soil particles less than 0.002 mm in diameter: usually consisting largely of clay minerals. As a soil textural class, soil materials that contain 40% or more clay, less than 45% sand and less than 40% silt.

Clod - A compact, coherent mass of soil produced by digging or plowing. Clods usually slake easily with repeated wetting and drying.

Coarse fragments - Rock or mineral particles greater than two mm in diameter.

Cobbles - Rock fragments eight to 25 cm (three to 10 inches) in diameter.

Color - Soil colours are compared with a Munsell color chart. The Munsell system specifies the relative degrees of the three simple variables of colour: hue, value and chroma. For example: 10YR 6/4 means a hue of 10YR, a value of six, and a chroma of four.

Columnar structure - Having prism-like aggregates with vertical edges near the top of columns, not sharp.

Complex (soil) - A mapping unit used in detailed and reconnaissance soil surveys, where two or more soil defined soil units are so intimately intermixed in an area that it is impractical to separate them at the scale of mapping used.

Concretion - Hard grains, pellets or nodules from concentration of chemical compounds (such as calcium carbonate or iron oxide) in the soil that cement soil grains together.

Conductivity, electrical - A physical quantity that measures the readiness with which a medium (irrigation water and soil extracts) transmits electricity. It expresses the concentration of salt in terms of the conductance (reciprocal of the electric resistance in ohms) in milliSiemens per cm (mS/cm) or deciSiemens per metre (dS/m).

Consistence (soil) - The mutual attraction of the particles in a soil mass, or their resistance to separation or deformation. Terms such as loose, soft, friable, firm, hard, sticky, plastic or cemented are used to describe consistence at various soil moisture contents.

Consumptive use factor (CU) - The ratio of consumptive use of water by a crop to potential evapo-transpiration and transpiration. An actively growing crop that completely covers the soil over a large area and that has an ample supply of readily available soil water has a consumptive use factor of 1.0.

Consumptive use of water - The sum of the depths of water transpired by the plants and evaporated from the soil surface and from intercepted precipitation. It may be less or greater than potential evapo-transpiration.

Contour - An imaginary line connecting points of equal elevation on the surface of the soil.

Cover - This term generally has one of the following meanings:

(i) Vegetation or other material providing protection; (ii) In forestry, low growing shrubs and herbaceous plants under trees (i.e., ground cover vs. tree cover); (iii) Any vegetation producing a protective mat on or

just above the soil surface.

Creep (soil) - Slow mass movement of soil and soil material down rather steep slopes, primarily under the influence of gravity, but aided by saturation with water and by alternate freezing and thawing.

Crotovina - A former animal burrow in one soil horizon that has become filled with organic matter or material from another horizon. It is also spelled krotovina.

Crust - A surface layer of soil, from a few millimetres to 2.5 cm (one inch) thick, that when dry is much more compact, hard and brittle than the soil material below.

Cryic layer - A perennially frozen layer.

Cryosolic - An order of mineral or organic soils that have permafrost, either within one metre of the surface or within two metres if the soil has been strongly cryoturbated laterally within the active layer, as indicated by disrupted, mixed, or broken horizons.

Cryoturbation - Frost action, including frost heaving.

Cultivation - Tillage to prepare land for seeding or transplanting, and later to control weeds and loosen the soil.

Decile portion - A one-tenth portion. As used in the soil map symbol A^7- B^3 means that soil A soil covers seven tenths and soil B covers three tenths of the map unit.

Deflocculate - To separate or to break up soil aggregates into individual particles by chemical or physical means or both.

Degradation (of soils) - The changing of a soil to a more highly leached and more highly weathered condition, usually accompanied by morphological changes such as the development of an eluviated, light colored (Ae) horizon.

Delta - A fluvial or glaciofluvial fan-shaped deposit at the mouth of a river that empties into a lake or sea.

Deposit - Material left in a new position by a natural transporting agent such as water, wind, ice, gravity, or by human activity.

Dispersion - Is rated high, moderate or low, depending on how readily the soil structure breaks down or slakes because of excess moisture. A rating of high indicates that soil aggregates slake readily. A rating of low indicates that aggregates are resistant to dispersion and remain clumped together.

Drainage (soil) - (i) The rate and extent of the removal of water from the soil by runoff and flow through the soil to underground spaces. (ii) As a condition of the soil, it refers to the frequency and duration of periods when the soil is free of saturation.

Drainage in soil reports is described on the basis of actual moisture content in excess of field capacity and length of the saturation period within the plant root zone. The terms are as follows:

Very rapidly drained - Water is removed from the soil very rapidly in relation to supply. Excess water flows downward very rapidly if underlying material is pervious. There may be very rapid subsurface flow during heavy rainfall, provided there is a steep gradient. Soils have very low available water storage capacity within the control section, and are usually coarse in texture, or shallow, or both. Water source is precipitation.

Rapidly drained - Water is removed from the soil rapidly in relation to supply. Excess water flows downward if underlying material is pervious. Subsurface flow may occur on steep gradients during heavy rainfall. Soils have low available water storage capacity within the control section, and are usually coarse in texture, or shallow, or both. Water source is precipitation.

Well drained - Water is removed from the soil readily, but not rapidly. Excess water flows downward readily into underlying pervious material, or laterally as subsurface flow. Soils have intermediate available water storage capacity within the control section, and are generally intermediate in texture and depth. Water source is precipitation. On slopes, subsurface flow may occur for short durations, but additions are equalled by losses. Soil horizons are usually bright colored. These soils are usually free of mottles within 100 cm of the surface, but may be mottled below this depth.

Moderately well drained - Water is removed from the soil somewhat slowly in relation to supply. Excess water is removed somewhat slowly due to low perviousness, shallow water table, lack of gradient, or some

combination of these. Soils have intermediate to high water storage capacity within the control section and are usually medium to fine in texture. Soils are commonly mottled in the 50 to 100 cm depth. Colours are dull brown in the subsoil with stains and mottles.

Imperfectly drained - Water is removed from the soil sufficiently slowly in relation to supply, to keep the soil wet for a significant part of the growing season. Excess water moves slowly downward if precipitation is major supply. If subsurface water, groundwater, or both, is the main source, flow rate may vary, but the soil remains wet for a significant part of the growing season. Precipitation is the main source if available water storage capacity is high. Contribution by subsurface flow, groundwater flow, or both, increases as available water storage capacity decreases. Soils have a wide range in available water supply, texture, and depth, and are gleyed phases of well drained subgroups. These soils generally have mottling below the surface layers and generally have duller colours with depth, generally brownish gray with mottles of yellow and gray.

Poorly drained - Water is removed so slowly in relation to supply that the soil remains wet for a comparatively large part of the time the soil is not frozen. Excess water is evident in the soil for a large part of the time. Subsurface flow, groundwater flow, or both, in addition to precipitation, are main water sources; there may also be a perched water table, with precipitation exceeding evapotranspiration. Poorly drained soils have a wide range in available water storage capacity, texture and depth.

Very poorly drained - Water is removed from the soil so slowly that the water table remains at or on the surface for the greater part of the time the soil is not frozen. Excess water is present in the soil for the greater part of the time. Groundwater flow and subsurface flow are major water sources. Precipitation is less important, except where there is a perched water table with precipitation exceeding evapotranspiration. These soils have a wide range in available water storage capacity, texture and depth.

Drained phase - Soils with extensive surface or subsurface (tile) drainage improvements.

Drumlin - An elongate or oval hill of glacial drift, commonly glacial till, deposited by glacier ice and having its long axis parallel to the direction of ice movement.

Dryland farming - The practice of crop production in low rainfall areas, without irrigation.

Dunes - Wind-built ridges and hills of sand formed in the same manner as snowdrifts.

Eluvial horizon - A horizon from which material has been removed in solution or in water suspension.

Eolian - Soil material accumulated through wind action.

Erosion - The wearing away of the land surface by detachment and transport of soil and rock material through the action of moving water, wind or other geological processes. The ratings of erosion are:

Erosion 1 slightly eroded - soil with a sufficient amount of the A horizon removed that ordinary tillage will bring up and mix the B horizon or other lower lying horizons with surface soil in the plow layer.

Erosion 2 moderately eroded - soil with all of the A horizon and a part of the B or other lower lying horizons removed. The plow layer consists mainly of the original horizons below the A or below the original plow layer.

Erosion 3 severely eroded - soils have practically all of the original surface soil removed. The plow layer consists mainly of C horizon material, especially on knolls and steep upper slope positions.

Esker - A winding ridge of irregularly stratified sand, gravel and cobbles deposited under the ice by a rapidly flowing glacial stream.

Evapotranspiration - The combined loss of water from a given area, and during a specific period of time, by evaporation from the soil surface and transpiration from plants.

Exchange acidity - The amount of hydrogen and aluminium that can be replaced from the adsorption complex by a neutral salt solution. It is usually expressed as milliequivalents per 100 g of soil (meq/100 g soil).

Exchangeable sodium percentage - The extent to which the adsorption complex of a soil is occupied by sodium. It is expressed as:

$$\text{ESP} = \frac{\text{exchangeable sodium (meq/100 g soil)}}{\text{cation exchange capacity (meq/100 g soil)}} \times 100.$$

Extract, soil - The solution separated from a soil suspension or from a soil by filtration, centrifugation, suction or pressure.

Fen - A peat-covered or peat-filled area, generally not acidic, in which grasses, sedges, or reeds are dominant. The water table is at the surface for most of the year.

Fibric - The least decomposed of all organic materials. There is a large amount of well preserved fibre that is readily identifiable as to botanical origin. Fibres retain their character upon rubbing.

Field Moisture Equivalent - The minimum moisture content at which a drop of water placed on a smoothed surface of the soil will not be absorbed immediately by the soil, but will spread out over the surface and give it a shiny appearance.

Field capacity - The percentage of water remaining in the soil two or three days after the soil has been saturated and free drainage has practically ceased. It is also defined as the maximum amount of water that will normally be held in the soil and be useful to plants. The percentage may be expressed in terms of weight or volume.

Fifteen - atmosphere percentage - The percentage of water contained in a soil that has been saturated, subjected to, and is in equilibrium with, an applied pressure of 15 atm. Pressure is applied in a pressure membrane or ceramic pressure plate apparatus. This moisture content approximates the permanent wilting point of a soil.

Flood plain - The land bordering a stream, built up of sediments from overflow of the stream and subject to inundation when the stream is at flood stage.

Fluvial deposits - All sediments past and present, deposited by flowing water, including glaciofluvial deposits.

Fragipan - A natural subsurface horizon having a higher bulk density than the solum above. It is seemingly cemented when dry, but showing moderate to weak brittleness when moist.

Friable - A consistence term pertaining to soil aggregates that are soft and easily crushed between thumb and forefinger.

Frost heave - The raising of the surface caused by ice in the subsoil.

Glacio-fluvial deposits - Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. These deposits are stratified and may occur in the form of outwash plains, deltas, kames, eskers and kame terraces.

Glacial-lacustrine deposits - Silt and clay sediments formed in the quiet waters of lakes that received meltwater from glaciers.

Glacial outwash -Well sorted sand, or sand and gravel, deposited by meltwater from a glacier.

Gleyed soil - An imperfectly or poorly drained soil in which the material has been modified by reduction or alternating reduction and oxidation. These soils have lower chromas or more prominent mottling or both, in some horizons than the associated well-drained soil.

Gleysolic - An order of soils developed under wet conditions and permanent or periodic reduction. These soils have low chromas or prominent mottling or both, in some horizons.

Gravel - Rock fragments two mm to 7.5 cm in diameter.

Granular structure - The arrangement of soil particles into spheroidal aggregates, characterized by rounded vertices.

Ground moraine - An unsorted mixture of rocks, boulders, sand, silt and clay deposited by glacial ice. The predominant material is till. Most till is thought to have accumulated under the ice by lodgment, but some till has been let down from the upper surface of the ice by ablation. Resorting and modification may have taken place to some extent by wave action of glacial melt waters. The topography is most commonly in the form of undulating plains, with gently sloping hills and enclosed depressions.

Groundwater - Water beneath the soil surface, usually under conditions where the voids are completely filled with water (saturation).

Grumic - Very fine textured soils with self-mulching horizons (A and B), that occur in the Chernozemic, Gleysolic, and Solonetzic orders. Redefined as vertic features in 1998, Third Edition of the Canadian System of Soil Classification.

Halophytic vegetation - Vegetation that grows naturally in soils having a high content of various salts. It usually has fleshy leaves or thorns and resembles desert vegetation.

Heavy soil - A soil having a high content of fine particles, particularly clay, or a soil having a high drawbar pull and therefore, hard to cultivate.

Horizon (soil) - A layer in the soil profile approximately parallel to the land surface, with more or less well-defined characteristics that have been produced through soil forming processes. It differs from adjacent layers in properties such as colour, structure, texture, consistence, and chemical, biological and mineralogical composition.

Horizon boundary - The lower boundary of each horizon is described by indicating its distinctness and form. The distinctness depends on the abruptness of vertical change (thickness). The form refers to the variation of the boundary plane.

Distinctness		Form	
abrupt	- less than two cm	smooth	- nearly plain
clear	- two to five cm	wavy	- pockets are wider than deep
gradual	- five to 15 cm	irregular	- pockets are deeper than wide
diffuse	- more than 15 cm	broken	- parts of the horizon are unconnected with other parts

Humic - Highly decomposed organic soil material. Small amounts of fibre are present that can be identified as to their botanical origin. Fibres are easily destroyed by rubbing.

Humus - The fraction of the soil organic matter that remains after most of the added plant and animal residues have decomposed. It is usually dark coloured.

Hydraulic conductivity - Refers to the effective flow velocity or discharge velocity in soil at unit hydraulic gradient. It is an approximation of the permeability of the soil and is expressed in cm per hour. The classes are described in general or specific terms as:

High	>15	cm/hr
Medium	0.5 -15	cm/hr
Low	< 0.5	cm/hr

Hydrologic cycle - The conditions through which water naturally passes, from the time of precipitation, until it is returned to the atmosphere by evaporation and is again ready to be precipitated.

Hydromorphic soil - A general term for soils that develop under conditions of poor drainage in marshes, swamps, seepage areas or flats.

Hydrophyte - Plants growing in water or dependent upon wet or saturated soil conditions for growth.

Illuvial horizon - A soil horizon in which material carried from an overlying layer has been precipitated from solution or deposited from suspension as a layer of accumulation.

Impeded drainage - A condition that hinders the movement of water by gravity through the soils.

Impervious - Resistance to penetration by fluids or roots.

Inclusion - Soil type (series) found within a mapping unit that is not extensive enough to be mapped separately or as part of a complex.

Infiltration - The downward entry of water into the soil.

Irrigation - The artificial application of water to the soil for the benefit of growing crops.

Irrigation requirement (IR) - Refers to the amount of water exclusive of effective precipitation that is required for crop production.

Kame - An irregular ridge or hill of stratified glacial drift deposited by glacial meltwater.

Kettle - Depression left after the melting of a detached mass of glacier ice buried in drift.

Lacustrine deposits - Material deposited by, or settled out of lake waters, and exposed by lowering of the water levels or elevation of the land. These sediments range in texture from sand to clay and are usually varved (layered annual deposits).

Land classification - The arrangement of land units into various categories, based on the properties of the land or its suitability for some particular purpose.

Landforms -The various shapes of the land surface resulting from a variety of actions, such as deposition or sedimentation. Mineral landforms are described by terms such as apron, blanket, fan, hummocky, level, pitted, ridged, rolling, terrace, undulating, veneer, inclined and steep.

Apron - A relatively gentle slope at the foot of a steeper slope and formed by materials from the steeper, upper slope.

Blanket - A mantle of unconsolidated materials that is thick enough to mask minor irregularities in the underlying unit, but still conforms to the general underlying topography.

Fan - A fan-shaped form similar to the segment of a cone and possessing a perceptible gradient from the apex to the toe.

Hummocky - A very complex sequence of slopes extending from somewhat rounded depression or kettles of various sizes to irregular, conical knolls or knobs. There is a general lack of concordance between knolls and depressions. Slopes are generally five to 70% (3 to 35°).

Level - A flat or very gently sloping, unidirectional surface with a generally constant slope not broken by marked elevations and depressions. Slopes are generally less than two per cent (1°).

Pitted - A level to gently undulating surface containing a number of pits or hollows.

Ridged - A long, narrow elevation of the surface, usually sharp crested with steep sides. The ridges may be parallel, sub-parallel, or intersecting.

Rolling - A very regular sequence of moderate slopes, extending from rounded, sometime confined, concave depressions to broad, rounded convexities with a wavelike pattern of moderate relief. Slope length is often 1.6 km or greater and gradients greater than five per cent (3°).

Terrace - Scarp face and the horizontal; or gently inclined surface (tread) above it.

Undulating - A very regular sequence of gentle slopes that extend from rounded, sometimes confined concavities to broad, rounded convexities, producing a wavelike pattern of low local relief. Slope length is generally less than 0.8 km and the dominant slope gradient is two to five per cent (1 to 3°).

Veneer - Unconsolidated materials too thin to mask the minor irregularities of the underlying unit surface. A veneer ranges from 10 cm to one metre in thickness and possesses no form typical of the materials' genesis.

Inclined - A sloping, unidirectional surface with a generally constant slope not broken by marked irregularities. Slopes are two to 70% (1 to 35°). The form of inclined slopes is not related to the initial mode of origin of the underlying material.

Steep - Erosional slopes, greater that 70% (35°), on both consolidated and unconsolidated materials. The form of steep erosional slopes on unconsolidated materials is not related to the initial mode of origin of the underlying material.

Landscape - All the natural features such as fields, hills, forest, water, etc., which distinguish one part of the earth's surface from another part.

Leaching - The removal from the soil of materials in solution.

Lime, agricultural - A soil amendment consisting principally of calcium carbonate, and including magnesium

carbonate and perhaps other materials. It is used to supply calcium and magnesium as essential elements for growth of plants, and to neutralize soil acidity.

Liquid limit (upper plastic limit) - The water content corresponding to an arbitrary limit between the liquid and plastic states of consistency of a soil. The water content at this boundary is defined as that at which a part of soil cut by a groove of standard dimensions will flow together for a distance of l.25 cm under the impact of 25 blows in a standard liquid limit apparatus.

Lineal shrinkage - This is the decrease in one dimension expressed as a percentage of the original dimension of the soil mass when the moisture content is reduced from a stipulated percentage (usually field moisture equivalent) to the shrinkage limit.

Lithic phase - Soils having a lithic contact (consolidated bedrock) within the control section below a depth of 10 cm.

Luvisolic - An order of soils that have eluvial (Ae) horizons, and illuvial (Bt) horizons, in which silicate clay is the main accumulation product. The soils developed under forest or forest-grassland transition in a moderate to cool climate.

Mapping Unit - Any delineated area shown on a soil map that is identified by a symbol. A mapping unit may be a soil unit, a miscellaneous land type, or a soil complex.

Marsh - Periodically flooded or continually wet areas having the surface not deeply submerged. It is covered dominantly with sedges, cattails, rushes or other hydrophytic plants. The waters are rich in nutrients, varying from fresh to highly saline.

Mature soil - A soil having well-developed soil horizons produced by the natural processes of soil formation.

Mesic - Organic material in an intermediate stage of decomposition. Intermediate amounts of fibre are present that can be identified as to their botanical origin.

Mesophyte - Plants requiring intermediate moisture conditions and are not very resistant to drought.

Microrelief - Small-scale, local differences in relief, including mounds, swales or hollows.

Milliequivalent (meq) - One-thousandth of an equivalent. An equivalent is the weight in grams of an ion or compound that combines with or replaces one gram of hydrogen. The atomic or formula weight divided by valence.

Mineral soil - A soil consisting predominantly of, and having its properties by, mineral matter. It contains less than 17% organic carbon, except for an organic layer that may be up to 40 cm (16 inches) thick if formed from mesic and humic peat, or 60 cm (24 inches) if of fibric peat.

Monolith, soil - A vertical section of a soil profile removed from the soil and mounted for display or study.

Mottles - Irregularly marked spots or streaks, usually yellow or orange, but sometimes blue. They are described in order of abundance (few, common, many), size (fine, medium, coarse) and contrast (faint, distinct, prominent). Mottles in soils indicate poor aeration and lack of good drainage.

Neutral soil - A soil in which the surface layer, to plow depth, is neither acid nor alkaline in reaction.

Organic carbon - Carbon derived from plant and animal residues.

Organic - An order of soils that have developed dominantly from organic deposits. The majority of organic soils are saturated for most of the year, unless artificially drained. They contain more than 17% organic carbon, and the organic layer must be up to 40 cm (16 inches) if formed from mesic and humic peat, or 60 cm (24 inches) if of fibric peat.

L, F, and H - These organic horizons developed primarily from the accumulation of leaves, twigs and woody materials, with or without a minor component of mosses. They are normally associated with upland forested soils, with imperfect drainage or drier conditions.

Organic matter - The fraction of the soil that consists of plant and animal residues at various stages of decomposition, cells and tissues of soil organisms, and substances synthesized by the soil population. It is determined on soils that have been sieved through a 2.0 mm sieve. It is estimated by multiplying the organic carbon by a factor of 1.72.

Outwash - Sediments washed out beyond the glacier by flowing water and laid down in thin beds or strata. Particle size may range from boulders to silt.

Ovendry soil - Soil that has been dried at 105 degrees C until it has reached constant weight.

Parent material - The unaltered or essentially unaltered mineral or organic material from which the soil profile develops by pedogenic processes.

Particle size, soil - The grain size distribution of the whole soil including the coarse fraction. It differs from texture, which refers to the fine earth (less than two mm) fraction only. In addition, textural classes are usually assigned to specific horizons, whereas soil family particle-size classes indicate a composite particle size of a part of the control section that may include several horizons. The particle-size classes for family groupings are as follows:

Fragmental - Stones, cobbles and gravel, with too little fine earth to fill interstices larger than one mm.

Sandy-skeletal - Particles coarser than two mm occupy 35% or more by volume, with enough fine earth to fill interstices larger than one mm. The fraction finer than two mm is that defined for the sandy particle size class.

Loamy-skeletal - Particles two mm to 25 cm occupy 35% or more by volume, with enough fine earth to fill interstices larger than one mm. The fraction finer than two mm is that defined for the loamy, particle-size class.

Clayey-skeletal - Particles two mm to 25 cm occupy 35% or more by volum,e with enough fine earth to fill interstices larger than one mm. The fraction finer than two mm is that defined for the clayey particle size class.

Sandy - The texture of the fine earth includes sands and loamy sands, exclusive of loamy, very fine sand and very fine sand textures. Particles two mm to 25 cm occupy less than 35% by volume.

Loamy - The texture of the fine earth includes loamy, very fine sand, very fine sand, and finer textures with less than 35% clay. Particles two mm to 25 cm occupy less than 35% by volume.

Coarse-loamy - A loamy particle size that has 15% or more by weight of fine sand (0.25 - 0.1 mm) or coarser particles, including fragments up to 7.5 cm, and has less than 18% clay in the fine earth fraction.

Fine-loamy - A loamy particle size that has 15% or more by weight of fine sand (0.25 - 0.1 mm) or coarser particles, including fragments up to 7.5 cm, and has 18 to 35% clay in the fine earth fraction.

Coarse-silty - A loamy particle size that has less than 15% of fine sand (0.25 - 0.1 mm) or coarser particles, including fragments up to 7.5 cm, and has less than 18% clay in the fine earth fraction.

Fine-silty - A loamy particle size that has less than 15% of fine sand (0.25 - 0.1 mm) or coarser particles, including fragments up to 7.5 cm, and has 18 to 35% clay in the fine earth fraction.

Clayey - The fine earth contains 35% or more clay by weight, and particles two mm to 25 cm occupy less than 35% by volume.

Fine-clayey - A clayey particle size that has 35 to 60% clay in the fine earth fraction.

Very fine-clayey - A clayey particle size that has 60% or more clay in the fine earth fraction.

Peat - Soil material consisting largely of undecomposed, or slightly decomposed, organic matter.

Peaty phase - Any mineral soil having a surface horizon 15 to 60 cm thick of fibric organic material, or 15 to 40 cm of mesic or humic organic material.

Ped - An individual soil aggregate such as granule, prism or block, formed by natural processes (in contrast with a clod, which is formed artificially).

Pedology - Those aspects of soil science dealing with the origin, morphology, genesis, distribution, mapping and classification of soils.

Percolation - The downward movement of water through soil. Specifically, the downward flow of water in saturated or nearly saturated soil at hydraulic gradients of 1.0 or less.

Permafrost - (i) Perennially frozen material underlying the solum. (ii) A perennially frozen soil horizon.

Permafrost table - The upper boundary of permafrost, usually coincident with the lower limit of seasonal thaw (active layer).

Permeability - The ease with which water and air pass through the soil to all parts of the profile. See hydraulic conductivity.

pH - The intensity of acidity and alkalinity, expressed as the negative logarithm of the hydrogen ion concentration. A pH of seven is neutral, lower values indicate acidity and higher values alkalinity (see Reaction, soil).

Phase, soil - A soil phase is used to characterize soil and landscape properties that are not used as criteria in soil taxonomy. The major phase components are: erosion, slope, stones, salinity, texture, deposition and calcareousness.

Plastic Limit - The water content corresponding to an arbitrary limit between the plastic and the semisolid states of consistency of a soil.

Plasticity Index - The numerical difference between the liquid and the plastic limit. The plasticity index gives the range in moisture content, within which, a soil exhibits plastic properties.

Platy structure - Consisting of soil aggregates that have developed predominantly along the horizontal axes; laminated; flaky.

Podzolic - An order of soils having B horizons (Bh, Bhf, Bf) in which amorphous combinations of organic matter, Al, and usually Fe are accumulated.

Pore space - The part of the bulk volume of soil not occupied by soil particles, interstices or voids.

Potential evapotranspiration (PE) - The maximum quantity of water capable of being lost as water vapor, in a given climate, by a continuous stretch of vegetation covering the whole ground and well supplied with water.

Prismatic structure - A soil structure type having prism-like aggregates that have vertical axes longer than the horizontal axes.

Profile, soil - A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil - The degree of acidity or alkalinity of a soil, usually expressed as a pH value.
Soil reaction classes are characterized as follows:

	pH value
extremely acid	<4.5
very strongly acid	4.5 to 5.0
strongly acid	5.1 to 5.5
medium acid	5.6 to 6.0
slightly acid	6.1 to 6.5
neutral	6.6 to 7.3
mildly alkaline	7.4 to 7.8
moderately alkaline	7.9 to 8.4
strongly alkaline	8.5 to 9.0
very strongly alkaline	>9.0

Regolith - The unconsolidated mantle of weathered rock and soil material on the earth's surface.

Regosolic - An order of soils having no horizon development or development of the A and B horizons insufficient to meet the requirements of the other soil orders.

Relief - The elevation of inequalities of the land surface when considered collectively.

Runoff - The portion of the total precipitation on an area that flows away through stream channels. Surface runoff does not enter the soil. Groundwater runoff or seepage flow from groundwater enters the soil before reaching the stream.

Saline soil - A nonalkali soil that contains enough soluble salts to interfere with the growth of most crop plants. The conductivity of the saturation extract is greater than four millisiemens/cm (mS/cm), the

exchangeable-sodium percentage is less than 16, and the pH is usually less than 8.5. Approximate limits of salinity classes are:

non-saline	0 to 4 mS/cm
weakly saline	> 4 to 8 mS/cm
moderately saline	> 8 to 16 mS/cm
strongly saline	>16 mS/cm

Salinization - The process of accumulation of salts in the soil.

Salt-affected soil - Soil that has been adversely modified for the growth of most crop plants by the presence of certain types of exchangeable ions or of soluble salts. It includes soils having an excess of salts, or an excess of exchangeable sodium or both.

Sand - (i) A soil particle between 0.05 and two mm in diameter. (ii) Any one of five soil separates: very coarse sand, coarse sand, medium sand, fine sand, or very fine sand. The textural class name for any soil containing 85% or more of sand and not more than 10% of clay.

Saturation extract - The extract from a soil sample that has been saturated with water.

Saturation percentage - The moisture percentage of a saturated soil paste, expressed on an oven dry weight basis.

Seepage - (i) The escape of water downward through the soil. (ii) The emergence of water from the soil along an extensive line of surface, in contrast to a spring, where water emerges from a local spot.

Series, soil - A category in the Canadian System of Soil Classification. It consists of soils that have soil horizons similar in their differentiating characteristics and arrangement in the profile, except for surface texture, and are formed from a particular type of parent material.

Shrinkage limit - This is the moisture content at which an equilibrium condition of volume change is reached and further reduction in moisture content will not cause a decrease in the volume of the soil mass.

Shrinkage ratio - This is the ratio between the volume change and a corresponding change in moisture content. It equals the apparent specific gravity of the dried soil.

Silt - (i) Individual mineral particles of soil that range in diameter between 0.05 to 0.002 mm. (ii) Soil of the textural class silt contains greater than 80% silt and less than 12% clay.

Single-grained structure - A soil structure in which the soil particles occur almost completely as individual or primary particles. It is usually found in coarse (sandy) textured soils.

Slickenside - Smoothed surfaces along planes of weakness, resulting from the movement of one mass of soil against another in soils dominated by swelling clays.

Sodic soil - (i) A soil containing sufficient sodium to interfere with the growth of most crop plants. (ii) A soil having an exchangeable-sodium percentage of 15 or more.

Sodium-Adsorption Ratio (S.A.R.) - A ratio for soil extracts and irrigation waters used to express the relative activity of sodium ions in exchange reactions with other cations in the soil. SAR = $Na/((Ca+Mg)/2)^{1/2}$ where the concentrations are expressed as milliequivalents per litre.

Soil - The unconsolidated mineral material on the immediate surface of the earth that serves as a natural medium for the growth of land plants. Soil has been subjected to, and influenced by, genetic and environmental factors of: parent material, climate (including moisture and temperature effects), macro- and micro-organ-isms, and topography, all acting over a period of time.

Solonetzic - An order of soils thought to have developed from parent materials that were more or less uniformly salinized with salts high in sodium. The soils have a stained brownish solonetzic B (Bnt or Bn) horizon and a saline C horizon.

Solum - The upper horizons of a soil above the parent material and in which the processes of soil formation are active. It usually consists of A and B horizons.

Stones - Rock fragments greater than 25 cm (10 inches) in diameter.

Stoniness - The percentage of land surface occupied by stones. The classes of stoniness are defined as follows:

Stones 0. nonstony - Land having less than 0.01% of surface occupied by stones.

Stones 1. slightly stony - Land having 0.01 to 0.1% of surface occupied by stones. Stones are 15 to 30 cm in diameter and 10 to 30 m apart. The stones offer only slight to no hindrance to cultivation.

Stones 2. moderately stony - Land having 0.1 to three per cent of surface occupied by stones. Stones are 15 to 30 cm in diameter and two to 10 m apart. Stones cause some interference with cultivation.

Stones 3. very stony - Land having three to 15% of surface occupied by stones. Stones are 15 to 30 cm in diameter and one to two m apart. There are sufficient stones to constitute a serious handicap to cultivation.

Stones 4. exceedingly stony - Land having 15 to 50% of surface occupied by stones. Stones are 15 to 30 cm in diameter and 0.7 to 1.5 m apart. There are sufficient stones to prevent cultivation until considerable clearing has been done.

Stones 5. excessively stony - Land having more than 50% of surface occupied by stones. Stones are 15 to 30 cm in diameter and less than 0.7 m apart. The land is too stony to permit cultivation.

Storage capacity - Refers to the maximum amount of readily available water that can be stored within the rooting zone of a crop in a given soil. For practical irrigation purposes, 50% of the total soil water between field capacity and wilting point may be considered as readily available.

Stratified materials - Unconsolidated sand, silt and clay arranged in strata or layers. In stratified materials, a bed is a unit layer distinctly separable from other layers and is one or more cm thick, but a lamina is a similar layer less than one cm thick.

Structure, soil - The combination or arrangement of primary soil particles into aggregates of secondary soil particles, units or peds, which are separated from each other by surfaces of weakness. Structure is expressed in terms of grade, size class and shape type. Grade refers to the distinctness of aggregate development, and is described as structureless, weak, moderate or strong. Structureless refers to the absence of observable aggregation of definite orderly arrangement. The term amorphous is used if soil is massive or coherent, single-grained if noncoherent. The weak to strong aggregates vary in size and are described by class as fine, medium, coarse, and very coarse, depending on the shape types. The shape types refer to the dominant configuration of the aggregates and the way they are accommodated. The general shape types are plate-like, block-like and prism-like. The terms are:

Platy - Having thin, plate-like aggregates, with faces mostly horizontal.

Prismatic - Having prism-like aggregates, with the tops and edges appearing plane, level and somewhat angular.

Columnar - Having prism-like aggregates, with vertical edges near the top of columns, not sharp.

Granular - Having block-like aggregates that appear as spheroids or polyhedrons having plane or curved surfaces, which have slight or no accommodation to the faces of the surrounding peds.

Blocky - Having block-like aggregates with sharp, angular corners.

Subangular blocky - Having block-like aggregates, with rounded and flattened faces and rounded corners.

By convention, an aggregate is described in the order of grade, class and type (e.g. strong, medium, blocky). In the parent material of soils, the material with structural shapes may be designated as pseudo-blocky, pseudo-platy, etc.

Soil survey - The systematic examination, description, classification, and mapping of soil in an area.

Subangular blocky structure - Having block-like aggregates with rounded and flattened faces and rounded corners.

Sulfate hazard - Refers to the relative degree of attack on concrete by soil and water containing various amounts of sulfate ions. It is estimated from electrolyte measurements and salt analysis on selected profiles and soil samples, and by visual examination of free gypsum within the profile during the course of soil investigation.

Swamp - A mineral wetland or peatland with standing water or water gently flowing, through pools or channels. The water table is usually at or near the surface. The vegetation is characterized by a cover of deciduous or coniferous trees or shrubs, herbs, and some mosses.

Texture, soil - The relative proportions of the fine earth (less than two mm) fraction of a soil. Textural classes are usually assigned to specific horizons whereas family particle size classes indicate a composite particle size of a portion of the control section that may include several horizons.

Name of separate	**Diameter (mm)**
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	< 0.002
Fine clay	< 0.0002

Textural Classes

Sand - Sand is a soil material that contains 85% or more sand. The percentage of silt, plus 1.5 times the percentage of clay, does not exceed 15.

Coarse sand – Twenty five per cent or more very coarse and coarse sand, and less than 50% any other one grade of sand.

(Medium) Sand – Twenty five per cent or more very coarse, coarse, and medium sand (but less that 25% very coarse and coarse sand), and less that 50% of either fine or very fine sand.

Fine sand – Fifty per cent or more fine sand, or less than 25% very coarse, coarse, and medium sand and less that 50% very fine sand.

Very fine sand – Fifty per cent or more very fine sand.

Loamy sand - Loamy sand is a soil material that contains at the upper limit 85 to 90% sand, and the percentage of silt, plus 1.5 times the percentage of clay, is not less than 15. At the lower limit, it contains not less than 70 to 85% sand, and the percentage of silt plus twice the percentage of clay does not exceed 30.

Loamy coarse sand – Twenty five per cent or more very coarse and coarse sand, and less that 50 per cent any other one grade of sand.

Loamy sand – Twenty five per cent or more very coarse, coarse, and medium sand (but less that 25% very coarse and coarse sand), and less that 50% fine or very fine sand.

Loamy fine sand – Fifty0 per cent or more find sand, or less than 50% very fine sand and less than 25% very coarse, coarse, and medium sand.

Loamy very fine sand – Fifty per cent or more very fine sand.

Sandy loam - Sandy loam is a soil material that contains either 20% clay or less, with the percentage of silt plus twice the percentage of clay exceeding 30, and 52% or more sand, or less than seven per cent clay, less that 50% silt, and 43 to 52% sand.

Coarse sandy loam – Twenty five per cent or more very coarse and coarse sand, and less than 50% any other one grade of sand.

(Medium) Sandy loam – Thirty per cent or more very coarse, coarse, and medium sand (but less than 25% very coarse and coarse sand), and less than 30% of either very fine or fine sand.

Fine sandy loam – Thirty per cent or more fine sand and less than 30% very fine sand, or between 15 to 30% very coarse, coarse, and medium sand, or more than 40% fine and very fine sand, at least half of which is fine sand, and less that 15% very coarse, coarse and medium sand.

Very fine sandy loam – Thirty per cent or more very fine sand, or more than 40% fine and very find sand, at least half of which is very fine sand, and less that 15% very coarse, coarse, and medium sand.

Loam - Loam is a soil material that contains seven to 27% clay, 28 to 50% silt, and less than 52% sand.

Silt loam - Silt is a soil material that contains 50% or more silt and 12 to 27% clay, or 50 to 80% silt and less than 12% clay.

Silt - Silt is a soil material that contains 80% or more silt and less than 12% clay.

Sandy clay loam - Sandy clay loam is a soil material that contains 20 to 35% clay, less than 28% silt, and 45% or more sand.

Clay loam - Clay loam is a soil material that contains 27 to 40% clay and 20 to 45% sand.

Silty clay loam - Silty clay loam is a soil material that contains 27 to 40% clay and less than 20% sand.

Sandy clay - Sandy clay is a soil material that contains 35% or more clay and 45% or more sand.

Silty clay - Silty clay is a soil material that contains 40% or more clay and 40% or more silt.

Clay - Clay is a soil material that contains 40% or more clay, less that 45% sand, and less that 40% silt.

Heavy clay - Heavy clay is a soil material that contains more that 60% clay.

In addition to these thirteen basic soil textural classes, three of which are modified according to the predominant sand fraction, other modifiers are added. The word mucky is used as an adjective modifying the textural class name for horizons of mineral soils, especially of Humic Gleysols that contain 15 to 30% organic matter (nine to 17% organic carbon).

Rock fragments in the soil are also used to modify the textural class name. These are gravel, cobbles, stones, and boulders (see the descriptions of size classes). The adjective form of the rock fragment class name is used as a modifier according to the following rules:

Less than 15% by volume: No special term is used, or non-gravelly and non-stony are used in writing for contrast with soils having more that 15% pebbles, cobbles, stones or boulders.

15 to 35% by volume: The adjective term of the dominant kind of rock fragment is used as a modifier of the textural terms: gravelly loam, stony loam and bouldery loam.

35 to 60% by volume: The adjective term of the dominant kind of rock fragment is used with the word very as a modifier to the textural terms: very gravelly loam, and very bouldery loam.

More than 60% by volume: If enough fine earth is present to determine the texture class (approximately five per cent or more by volume), the adjective term of the dominant kind of rock fragment is used with the word extremely as a modifier of the textural terms: extremely gravelly loam, and extremely bouldery loam. If there is too little fine earth to determine the texture class (less than about five per cent by volume) the terms gravel, cobbles, stones and boulders are used in the place of fine earth texture.

Till, glacial - Unstratified glacial drift deposited by ice and consisting of clay, sand, gravel, and boulders intermingled in any proportion.

Tilth - The physical condition of soil as related to its ease of tillage, fitness as a seedbed, and its impedance to seedling emergency and root penetration.

Topography - Refers to the per cent slope and the pattern or frequency of slopes in different directions. A set of 10 slope classes are used to denote the dominant, but not necessarily most abundant slopes within a mapping unit.

Slope Class	Slope Name	Per cent slope	Approximate degrees
1	level	0 - 0.5	0
2	nearly level	0.5 - 2.5	0 .3 - 1.5
3	very gentle	2 - 5	1 - 3
4	gentle	6 - 9	3.5 - 5
5	moderate	10 - 15	6 - 8.5
6	strong	16 - 30	9 - 17
7	very strong	31 - 45	17 - 24
8	extreme	46 - 70	25 - 35
9	steep	71 - 100	35 - 45
10	very steep	> 100	> 45

Underground runoff (or seepage) - Water flowing towards stream channels after infiltration into the ground.

Unified Soil Classification System (engineering) - A classification system based on the identification of soils according to their particle size, gradation, plasticity index and liquid limit.

Urban Land - Areas so altered or obstructed by urban works or structures that identification of soils is not feasible.

Variant, soil - A soil whose properties are believed to be sufficiently different from other known soils to justify a new series name, but comprising such a limited geographic area that creation of a new series is not justified.

Varve - A distinct band representing the annual deposit in sedimentary materials, regardless of origin and usually consisting of two layers: one thick light coloured layer of silt and fine sand laid down in the spring and summer, and the other a thin, dark coloured layer of clay laid down in the fall and winter.

Water balance, soil - Is the daily amount of readily available water retained by the soil. The daily soil-water balance is decreased by the amount that the daily consumptive use exceeds the daily rainfall. When daily rainfall exceeds the consumptive use, the daily balance increases by the amount of the difference, unless the soil-water balance is at storage capacity, in which case the excess is assumed to be lost by runoff or deep percolation.

Water table - (groundwater surface; free water surface; groundwater elevation) Elevation at which the pressure in the water is zero with respect to the atmospheric pressure.

Water table depths	(cm)
Generally High	< 100
Very High	0 - 50
Moderately High	250 - 100
Medium High	100 - 150
Generally Low	> 150
Medium Low	150 - 200
Low	> 200
Moderately Low	200 - 300
Very Low	> 300

Water-holding capacity - The ability of a soil to hold water against the force of gravity in a freely drained soil.

Weathering - The physical and chemical disintegration, alteration and decomposition of rocks and minerals at or near the earth's surface by atmospheric agents.

Wilting point - The moisture content of a soil, at which plants wilt and fail to recover their turgidity when placed in a dark, humid atmosphere. The wilting point is commonly estimated by measuring the 15-atmosphere moisture content of a soil.

Xerophyte - Plants capable of surviving extended periods of soil drought.

Bibliography

Anon. 1965. Soil Capability Classification for Agriculture. The Canada Land Inventory, Report No. 2. Department of Forestry, Ottawa, Canada.

Coen et al. 1977. Soil Survey of Yoho National Park, Canada. Alberta Soil Survey Report No. 37, 208 pp. Alberta Institute of Pedology, University of Alberta, Edmonton, Alberta.

Corkery, T. M. 1996. Geology and Landforms of Manitoba. In Welsted, J., Everitt, J. and Stadel, C. (1996). The Geogrpahy of Manitoba; Its Land and its People. Manitoba. The University of Manitoba Press.

CSSC. 1973. Canada Soil Survey Committee. Proceedings of the Ninth Meeting of the Canada Soil Survey Committee. University of Saskatchewan, Saskatoon. 357 pp.

Ehrlich, W. A., Poyser, E. A. and Pratt, L. E. 1957. Reconnaissance Soil Survey of Carberry Map Sheet Area, Soils Report No. 7, Manitoba Soil Survey, Manitoba Department of Agriculture.

Ehrlich, W. A., Pratt, L. E., and Poyser, E.A. 1956. Reconnaissance Soil Survey of Rossburn and Virden Map Sheet Areas, Soils Report No. 6, Manitoba Soil Survey, Manitoba Department of Agriculture.

Environment and Natural Resources Canada. 2019. Canadian Climate Normals & Averages for Brandon A 1981-2010. Accessed April 2020. (https://climate.weather.gc.ca/climate_normals/results_1981_2010_e.html?searchType=stnProv&lstProvince=MB&txtCentralLatMin=0&txtCentralLatSec=0&txtCentralLongMin=0&txtCentralLongSec=0&stnID=3471&dispBack=0)

Henry, L., Harron, B. And Flaten, D. 1987. The Nature and Management of Salt-Affected Land in Saskatchewan Agdex 518, Soils and Crops Branch, Saskatchewan Agriculture.

ISC. 1987. An Irrigation Suitability Classification System for the Canadian Prairies. Working Group on Irrigation Suitability Classification. Research Branch, Agriculture, LRRC, Contribution 87-83.

Manitoba Land Resource Unit, Centre for Land and Biological Resources Research, Agriculture and Agri-Food Canada; Department of Soil Science, University of Manitoba; and Manitoba Soil Resource Section, Soils and Crops Branch, Manitoba Agriculture. 2001. Soils and Terrain Information Bulletins 96-11, Rural Municipality of Elton: An introduction to the land resources.

Michalyna, W., Podolsky, G. P. and Gardiner, Wm. 1976. Soils of the Brandon Region Study Area, Soils Report No. 30 (D15), Manitoba Dept. of Municipal Affairs, Municipal Planning Branch.

Podolsky, G.P., Schinder, D. 1994. Soils of the Manitoba Zero Tillage Research Association Research Farm; Special Report Series 94-3, Manitoba Agriculture, Agriculture and Agri-Food Canada and Department of Soil Science University of Manitoba.

Smith, R. E., H. Veldhuis, G. F. Mills, R. G. Eilers, W. R. Fraser, and G. W. Lelyk, 1998. Terrestrial Ecozones, Ecoregions, and Ecodistrict, An Ecological Stratification of Manitoba's Landscapes. Technical Bulletin 98-9E. Land Resource Unit, Brandon research Centre, Research Branch, Agriculture and Agri-Food Canada, Winnipeg, Manitoba. Report and map at 1:1,500,000 scale. CD-ROM 2001.

Soil Classification Working Group. 1998. The Canadian System of Soil Classification. Third Edition. Agric. and Agri-Food Can. Publ. 1646 (Revised). 187 pp.

USDA. 1971. Guide for Interpreting Engineering Uses of Soils. United States Department of Agriculture, Soil Conservation Service USDA, SCS - 45, 87 pp.